

RESEARCH ARTICLE

Prevalance and perpetuation of chilli fruit rot pathogen (*Colletotrichum* spp.)

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SUMMARY

Chilli (*Capsicum annum* L.) is one of the most important spice crop grown in India. *Colletotrichum* spp. viz., which is the casual agent of anthracnose disease and has been reported to cause infection and also cause infection in humans. During the survey in chilli growing areas of western Maharashtra among the seven districts maximum incidence (24%) of fruit rot was observed in Pune district. Three species of *Colletotrichum*, viz., *Colletotrichum capsici*, *Colletotrichum gloeosporioides* and *Colletotrichum acutatum* are known to be associated with fruit rot. Perpetuation studies revealed that the conidia of three *Colletotrichum* spp. got perpetuated in both sterile soil and field soil but viability of conidia was maximum in sterile soil. Conidia of all three species survived upto 60 days in sterile soil but conidia completely lost viability within 60 days in field soil. The diseased fruit also showed reduction in capsaicin content by 34.7 per cent.

Key Words : Chilli fruit rot, *Colletotrichum* spp., Prevalence, Viability, Fruit quality

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Chilli has its unique place in the world diet in its ripe dried form as well as green fruits and forms an indispensable adjuvant in almost every house. The consumption of chilli is mainly due their pungent

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flavor and seven closely related alkaloids. Pungency is a key characteristic associated with members of genus capsicum and is caused by capsaicinoids and among the most abundant of these components are capsaicin and dihydrocapsaicin, which are responsible for about 90 per cent of total pungency. India is the major producer and consumer of *Capsicum annum*. Maharashtra state ranks second with area 99.5 thousand ha and third in production with 45.6 thousand MT, respectively.

Anthracnose/fruit rot disease is a major problem in India and one of the more significant economic constraints of capsicum production worldwide, the disease causes both pre and post harvest fruit decay. *Colletotrichum*

sp. are the most common plant pathogenic fungi, usually occurring as asymptomatic endophytes on aerial organs of the host plants. They affect many different crops causing post harvest rots, spots and blights of plants

More seriously, five species of *Colletotrichum* viz., *Colletotrichum crassipes*, *Colletotrichum dematium*, *Colletotrichum gloeosporoides* and *Colletotrichum graminicola* have been reported to cause infection in humans also. These infections are keratitis following traumatic implantation, subcutaneous and systemic infections among immune suppressed patients.

Perusal of the literature reveals that expect the evaluation of fungicides against the casual pathogen, no systemic work on the prevalence and perpetuation of chilli rot pathogen has been done, no much information is available on the whether this fruit rot pathogen from dry infected chillies carry over to chilli powder which we consume it daily in different food stuff, an attempt was made to determine the prevalence of *Colletotrichum* spp in red chilli.

MATERIAL AND METHODS

The following research was conducted out at Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra.

Survey of disease incidence in western Maharashtra:

A survey of local markets in the chilli growing areas of Pune, Ahmednagar, Satara, Kolhapur, Nashik, Nandurbar, Dhule, districts of western Maharashtra. The observations of per cent disease incidence of fruit rot infection on chilli in different districts is recorded.

$$\text{Per cent disease incidence} = \frac{\text{No. of diseased fruits} \times 100}{\text{Total no. of fruits}}$$

Isolation of pathogen from infected chilli powder:

To check the carry over of pathogen from infected fruit to chilli powder diseased samples are grinded in to fine powder. 1 g of sample is weighed and transferred to test tubes containing 9 ml sterile distilled water and diluted to make six dilutions (10^{-6}) per sample one ml from each test tube is pipetted on to PDA and incubated for 4-7

days at 25°C. Fungal colonies were determined and number of fungal colonies per gram are calculated and expressed in colony forming units per gram of sample (Cfu/g) as:

$$\text{CFU/g} = \frac{\text{No. of fungal colonies} \times \text{Reciprocal of dilution factor}}{\text{Weight of powder} \times \text{Plating volume}}$$

Perpetuation in soil:

To check perpetuation in soil, field soil was collected from chilli plot of vegetable project, Rahuri, air dried in laboratory. The soil was divided into two equal parts and equal amount of FYM was mixed in to both parts. One part was sterilized by autoclaving twice for 30 min at 24 hrs interval. Both field and sterile soil were sieved through 2 mm sieve. Before inoculation both sterile and field soils are distributed into sterile pots and then inoculated with the obtained isolates of pathogens by thoroughly mixing to obtain a final concentration of 5×10^4 conidia/g of soil. The pots were kept in dark. Samples of 1g of soil were removed every 3rd, 7th, 15th, 30th, 45th and 60th days, respectively and suspended to serial dilution agar plating method for isolation of fungi from sterilized as well as field soil. The plates from sterilized and field soil samples were incubated for 24-96hr at 25±2°C.

Estimation of capsaicin:

The effect of pathogen infection on capsaicin content of healthy chilli and fruit rot infected chilli was done by capsaicin estimation by colorimetric method (Quagliotti, 1971).

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Survey of disease incidence in western Maharashtra:

An extensive survey conducted during 2014-2016 from local markets of seven districts of Western Maharashtra to find out per cent incidence of fruit rot

Table 1: Conidial characters of three *Colletotrichum* species

Sr. No.	Host	Species	Conidia		
			Length (µm)	Width (µm)	Shape
1.	Chilli	<i>C. capsici</i>	17.5	3.0	Falcate
2.	Chilli	<i>C. gloeosporioides</i>	11.8	4.4	Cylindrical
3.	Chilli	<i>C. acutatum</i>	9.7	2.5	Fusiform

disease of chilli, the results revealed that, the maximum incidence was recorded in Pune district (24%) followed by Nashik (17%), Satara (16%), Kolhapur (14.6%), Ahmednagar (13.6%) and Nandurbar (9.3%). A minimum incidence was recorded in Dhule district (8.3%).

Isolation from diseased fruit:

To check the association of pathogen with diseased chilli fruit the isolation was carried out on the basal culture medium potato dextrose agar (PDA). Seven days of incubation, fungal colonies with profuse mycelia growth emerged from the diseased pieces of chilli fruits.

Isolation from chilli powder:

During the present investigations, the chilli powder prepared from 30 days old fruit rot infected dried red chillies yielded three *colletotrichum* species viz., *Colletotrichum capsici*, *Colletotrichum gloeosporioides* and *Colletotrichum acutatum* with total colony count of 1.6×10^3 cfu/g, 1.0×10^3 cfu/g and 1.3×10^3 cfu/g, respectively. The fungi (*Colletotrichum* spp.) were easily isolated on PDA and three species produce different colony characteristics.

Identification:

The fungi were identified as the *Colletotrichum capsici*, *Colletotrichum gloeosporioides* and *Colletotrichum acutatum* by cultural morphological and microscopic studies.

Pathogenicity test:

All the isolates were found pathogenic to chilli fruits. The symptoms developed by pathogenic isolates after 8 days of inoculation were similar to typical fruit rot symptoms. Reisolation attempted from artificially infected/diseased fruits on PDA consistently yielded *Colletotrichum capsici*, *Colletotrichum gloeosporioides* and *Colletotrichum acutatum* thus, fulfilling Kotch's postulates.

Perpetuation in soil:

It is revealed from the results that the conidia of *Colletotrichum* spp. get perpetuated in soil but in sterile soil, there was an increase (of approximately 2 times) in CFU during the first month, then there was decline to their original density 45 days after inoculation (Table 2). Conidia of *Colletotrichum* spp. survived upto 60 days with at least 6,000 propagules/g of sterile soil. In case of

Table 2: Perpetuation of conidia of *Colletotrichum capsici* in soil

Soil	Colonies of <i>Colletotrichum capsici</i> per gram of soil after incubation for number of days					
	3 days	7 days	15 days	30 days	45 days	60 days
Sterile	7.3×10^3	5×10^3	1.2×10^4	8.3×10^3	7×10^3	6×10^3
Field	6×10^3	4.6×10^3	3×10^3	1.6×10^3	1.3×10^3	0

Table 3: Perpetuation of conidia of *Colletotrichum gloeosporioides* in soil

Soil	Colonies of <i>Colletotrichum gloeosporioides</i> per gram of soil after incubation for number of days					
	3days	7 days	15 days	30 days	45 days	60 days
Sterile	7×10^3	6.3×10^3	1.3×10^4	9.3×10^3	7×10^3	4×10^3
Field	6.2×10^3	4×10^3	3.3×10^3	1.6×10^3	1.3×10^3	0

Table 4: Perpetuation of conidia of *Colletotrichum acutatum* in soil

Soil	Colonies of <i>Colletotrichum acutatum</i> per gram of soil after incubation for number of days					
	3 days	7 days	15 days	30 days	45 days	60 days
Sterile	6×10^3	4.6×10^3	7.3×10^3	1.24×10^4	6×10^3	3×10^3
Field	5.4×10^3	3×10^3	2.3×10^3	1.6×10^3	1×10^3	0

Table 5 : Estimation of capsaicin in healthy and diseased chilli fruits/powder

Parameter	Healthy Chilli	Diseased Chilli	% Reduction
Capsaicin content $\mu\text{g/g}$	4909	3239	34.7%

field soil, the decline in the viability of conidia was very rapid, resulting in a 50 per cent reduction in CFU within 8 to 10 days. Likewise, the time required for 95 per cent reduction in population ranged from 30 to 45 days. At 60 days conidia completely lose their viability.

Estimation of capsaicin:

The results presented reveals that there was decrease in capsaicin content in diseased chilli fruits/powder upto 34.7 per cent as compare to healthy chilli fruits/powder. Similar work related to the present investigation was also carried out by Anamika and Nath (1999); Angadi (1999); Chaudary and Varshney (2000); Datar (1995); Gaikwad and Sawant (2005); Kaur *et al.* (2005); Parey *et al.* (2013) and Tripathi and Mishra (2009).

Conclusion:

Colletotrichum spp. are one of the most destructive pathogens causing fruit rot in chill and inflicting accountable yield losses. these pathogens get carryover in to the chilli powder is of great concern for the health of people. Conidia of *Colletotrichum* spp. get perpetuated in soil are soil invader fungi because conidia survival is limited to 60 days.

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