

## Detection, Transmission and Management of Seed-borne Inoculum of Anthracnose (*Colletotrichum capsici*) in Chilli

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**ABSTRACT** *Colletotrichum capsici* (Syd.) Butler and Bisby, is one of the worst maladies in India which causes die back or ripe fruit rot in chilli. The fungus is seed-borne in nature and causes significant qualitative and quantitative losses. Standard blotter method is found to be the best for detection of the pathogen from seed. The pathogen is transmitted from infected seed to seedling and reduced germination in severely infected seeds. Seed treatment with *Trichoderma harzianum* + thiram gave maximum seedling emergence and reduced seed rot.

**Key words:** Anthracnose, *Colletotrichum capsici*, seed transmission, seed-borne inoculum

Chilli (*Capsicum annum*) forms an important part of the Indian diet and its fruits are used as a condiment, culinary supplement and as a salad. It is also important for its alkaloid capsacin, which is responsible for pungency. Anthracnose caused by *Colletotrichum capsici* (Syd.) Butler and Bisby, is one of the important diseases of chilli leads to substantial losses in seed quality. The disease is now considered as a major limiting factor in chilli cultivation. Seed-borne inoculum has been found to be responsible for reducing seed germination and causing seed rot. Present investigation was made to identify suitable methods to detect the seed-borne inoculum of *C. capsici* in chilli, transmission of seed-borne inoculum from seed to seedlings and management through seed treatment.

### MATERIALS AND METHODS

Naturally infected fruits showing anthracnose symptoms were collected and brought to laboratory for microscopic examination. Infected seeds showing high incidence of the disease were collected from infected pods. Dry seed examination and incubation methods such as

standard blotter method, 2,4-D method, deep freeze and agar plate methods [1] were used for the detection of seed-borne infection in both untreated and pre treated seeds (1% sodium hypochloride (NaOCl) solution for 3-4 min followed by 2-3 successive washing in sterilized distilled water).

Transmission of seed-borne inoculum of *Colletotrichum capsici* in different category of naturally infected seeds was studied in sterilized soil under controlled glasshouse conditions. Categorization of different degree of seed infection is based on the surface area of fruit infection. Correlation of surface pod area infected with per cent seed infection was carried using blotter method. Observations were made for diseased seedlings and seed rot.

Effect of seed treatment with fungicides and bio agent alone and in combination on seed germination and seed rot was studied under laboratory conditions following germination test.

### RESULTS AND DISCUSSION

The fungus causes die-back symptoms in the

infected plants and necrosis of tender twigs and the entire branch or the entire top of the infected plant in severe attack withers away (Fig. 1).

The affected fruits bear black dot like numerous scattered acervuli of the fungus leading to fruit discoloration which are more promising on ripe fruits leading to ripe rot symptoms which appear as small circular spots, later turning to more or less elliptical (Fig. 2). Such fruits when split open show minute elevated spherical stromatic masses or sclerotia of the fungus on the inner side of the infected fruits. Dry seed examination of infected seeds revealed the discolored and rusty appearance of the seed and they bear small pin head like structures on seed surface, the acervuli of the fungus (Fig. 3a). Black dots (acervuli) scattered all over the necrotic surfaces were also observed [2]. Blotter test has been found most effective for detection of seed borne inoculum as the recovery of the fungus was the maximum over other methods used. Maximum 15 per cent seed infection of *C. capsici* was recorded in untreated seeds as compared to 13 per cent in pre treated seeds (Table 1). Similar findings have been observed for detection of various fungi [2, 3].

The fungus appeared as black acervuli on seed surface. Infected seeds, when split open show acervuli deep inside the seed making the seed non-viable particularly when severely infected (Fig. 3b,c). In such seeds the germination is highly reduced. The per cent

**Table 1.** Detection of *C. capsici* in naturally infected chilli seeds

Methods	Per cent infection of <i>C. capsici</i>	
	Untreated	Pretreated
Standard blotter method	15.0	13.0
Standard agar plate method	13.0	12.0
Deep freeze blotter method	12.0	10.0
2,4-D method	9.0	7.0
CD at 5%	0.7	0.6

reduction in seed germination depended upon the degree of seed infection. Germination goes down to even 15 per cent in seeds having severe infection (Table 2).

Under controlled glasshouse conditions the pathogen gets transmitted from infected seeds to seedlings (Fig. 3e). Infected seeds often fail to germinate or if germinate, they give rise to infected seedlings producing chlorotic lesions on cotyledons or on hypocotyl region (Fig. 3e) in the earlier phases and later these girdled the stem leading to seedling collapse. The dead seedlings develop necrotic areas leading to fungal fructifications [4]. This study indicated that there may be possibilities of two pathways of invasion of the seed by *C. capsici*. Mycelium of the fungus present on the inner surface of diseased fruit invades seed through the seed coat and colonizes in the outer layer of the endosperm. Secondly, the pathogen could also infect the ruminant of

**Table 2.** Assessment of seed transmission of *C. capsici* from infected seed to seedling

Degree of seed infection	Seed germination (%)	Diseased seedlings (%)	Seed rot (%)
Trace	68.0	3.0	10.0
Mild	65.0	15.0	21.0
Moderate	50.0	32.0	45.0
Severe	15.0	75.0	85.0
Healthy	75.0	0.0	0.0
CD at 5%	6.83	7.53	8.66

**Table 3.** Correlation of surface pod area infected with per cent seed infection by blotter method

S.No.	Pod area infection (%)	Seed infection (%)
1	0-25	0-8.0
2	26-50	8.1-31.5
3	51-75	31.6-65.0
4	76-100	65.1-92.0



Fig. 1. Chilli plant showing die-back symptoms



Fig. 2. Infected fruits showing anthracnose symptoms



a



b



c



d



e



f

Fig. 3. a. infected seeds showing acervuli of the fungus; b. infected non viable seed c. healthy viable seed; d. enlarged view of a single seed showing acervuli on seed surface; e. infected seedlings; f. spores of *Colletotrichum capsici*

the placenta, enter the opening of the testa and become establish in this area or invade the outer layer of the endosperm and embryo region. The fungus, therefore, cause little damage to the growing plant but later on it reappears on ripe fruits under field conditions. The relationship between disease severity levels and infected seed and seedlings has also been reported earlier [5, 6]. This study reveals that the seed-borne inoculum serves as a potential source of infection in uninfested areas. The infection is also transmitted from seed to seedling in asymptomatic manner. The per cent seed infection is also correlated with the degree of pod area infected. The higher is the pod area infected the more seed infection is observed (Table 3).

Seed treatment with different fungicides and biocontrol agent (*T. harzianum*) alone and in combination improved seedling stand, reduced seed rot as compared to check. Maximum (82%) seedling emergence was recorded in thiram + *T. harzianum* than in thiram alone (80%). Rest of the treatments also improved seedling emergence over check. However, the combined effect of fungicides with biocontrol agent was found better over individual effect of each of the treatment. Antagonistic effect of *Trichoderma* was also reported earlier [7]. Seed rot was also reduced significantly in all chemical seed treatments alone

and in combination with biocontrol agent applied over check except in biocontrol agent alone where the seed rot was at par to check (Table 4).

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Table 4. Efficacy of different fungicides and bio-agent on seedling emergence and seed rot

S.No.	Treatment	Dose (g/kg seed)	Per cent seedling emergence	Per cent seed rot
1.	Thiram	3.0	80	5
2.	Carbendazim	3.0	75	6
3.	Vitavex	3.0	70	7
4.	<i>Trichoderma harzianum</i>	10.0	68	12
5.	Th.+ thiram 75WP	5g+1.5g	82	5
6.	Th.+ carbendazim 50WP	5g+1.5g	77	6
7.	Th.+ vitavax 50WP	5g+1.5g	72	7
8.	Check	-	65	15
	CD at 5%		2.87	0.51

Th.- *Trichoderma harzianum*