

## ROLE OF SEED AND SOIL IN PERENNATION OF THE BLIGHT AND WILT DISEASE OF CUMIN (*CUMINUM CYMINUM* L.) CAUSED BY *ALTERNARIA BURNSII* AND *FUSARIUM OXYSPORUM* F.SP. *CUMINI*

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*Alternaria* blight and *Fusarium* wilt are the most destructive diseases of cumin. The seeds and soil could play an important role in perennation of the both pathogens. So in our present investigation for confirmation of seed or soil borne nature of Blight and Wilt diseases of cumin by Standard Blotter Technique, Potato Dextrose Agar method and Pot experiments were conducted. Results showed that the perennation of both diseases occurred by seeds, plant part and by soil.

**Keywords :** *Alternaria burnsii*; Annual perennation; *Fusarium oxysporum*.

Cumin (*Cuminum cyminum* L.) belonging to family Apiaceae is an important condiment and occupies a significant place among the nonfood crops, grown in India. Blight disease of cumin caused by *Alternaria burnsii*<sup>1</sup> and wilt disease caused by *Fusarium oxysporum* f.sp. *cumini* are the most important and destructive diseases which cause substantial yield losses. The pathogen of blight disease carried through seed caused about 10-32 percent losses to the growers<sup>2</sup>. Besides Gujarat and Rajasthan the disease has been reported from West Bengal with seed borne nature<sup>3</sup>. Seed microflora studies carried out by Gemawat<sup>4</sup> revealed that pathogen was invariably present on the seed.

In wilt disease of cumin the transmission usually takes place in new areas by soil-borne and seed borne spores or through infected plant parts carried with the seeds<sup>5</sup>. Patel<sup>6</sup> reported the fungus to be externally seed borne, however, Singh *et al.*<sup>7</sup> and Champawat<sup>8</sup> found it to be both externally as well as internally seed borne. Edison<sup>9</sup> reported the fungus to be soil borne and internally seed-borne. In the present investigation studies were undertaken to confirm seed or soil borne nature of Blight and Wilt disease of cumin.

**Role of Seed and Plant Parts in Perennation of the Disease : Standard Blotter Technique (ISTA 1976) :** The seeds collected from infected crop of RZ-209 during 2002-2003 were tested by using standard blotter technique. Surface sterilized (by 2 percent sodium hypochlorite solution for 2-3 minutes) as well as unsterilized plant parts (seed, stem, leaf, root) were placed on 3 moistened blotter papers in sterilized petriplates under sterilized conditions. The plates were incubated for 7 days at 26±1°C in incubator. Observations were recorded for percent incidence in plant parts after examining under stereomicroscope.

**Potato Dextrose Agar Method :** Surface sterilized by 2 percent sodium hypochlorite solution for 2-3 minutes) as well as unsterilized plant parts from experimentally infected cumin plants were placed on PDA medium in petriplate. The plates were incubated at 26±1°C for 7 days and examined under stereomicroscope for the percent incidence in seeds.

**Role of Seed and Soil in Perennation of the Disease :** An experiment was conducted in cage house with four treatments and with three replicates of each treatment.

In treatment A the sterilized seeds were taken with sterilized soil. In treatment B unsterilized seeds were sown in sterilized soil. In treatment C the inoculated (*Alternaria*) fungus in unsterilized soil with sterilized seeds was taken. In treatment D the inoculated *Fusarium oxysporum* f.sp. *cumini* in unsterilized soil with sterilized seeds was used.

Seeds were collected from diseased and healthy plants of cumin. They were carefully observed under stereomicroscope for the presence or absence of infection on the seeds surface. During experimentation new soil was used for sterilization. The seeds were sterilized in 2 percent sodium hypochlorite solution and the soil was double sterilized in autoclave at 1.045 kg/cm<sup>2</sup> for twenty minutes. Ten seeds each were sown in 12 inch earthen pots. Observation was based on percentage and severity of disease.

The data presented in table 1, 2 and 3 showed that when surface sterilized seeds were sown in sterilized soil, very little disease incidence was observed. Only *Alternaria burnsii* was observed. When unsterilized seeds were sown in sterilized soil, both the pathogens were recorded. *Alternaria burnsii* appeared in younger plants and its incidence was more compared to *Fusarium*



**Table 1.** Occurrence of infection of *Alternaria burnsii* and *Fusarium oxysporum* f.sp. *cumini* in asymptomatic and symptomatic (weakly and heavily infected) sample of cumin plant in cleared wholemount preparations of samples.

Age of plant in weeks	Root				Leaf				Stem				Seed			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
1 <sup>st</sup>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 <sup>nd</sup>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3 <sup>rd</sup>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4 <sup>th</sup>	(+)	+	+	(+)	+	+	-	-	+	-	-	(+)	-	-	-	-
	-	+	+	(+)	-	-	+	(+)	-	-	+	-	-	-	-	-
	-	+	-	(+)	-	+	-	-	-	+	-	-	-	-	-	-
5 <sup>th</sup>	(+)	++	++	(+)	+	+	+	(+)	+	+	+	(+)	-	-	-	-
	-	+	+	(+)(+)	-	+	+	(+)(+)	-	+	+	(+)(+)	-	-	-	-
	-	+	+	(+)	-	+	-	(+)	-	+	-	(+)	-	-	-	-
6 <sup>th</sup>	(+)	++	+	(+)	+	+	+	(+)	+	+	+	(+)	-	-	-	-
	-	++	+++	(+)	-	+	+	(+)(+)	-	+	+	(+)(+)	-	-	-	-
	-	+	-	(+)	-	+	-	(+)	-	+	-	(+)	-	-	-	-
7 <sup>th</sup>	(+)	++	+	(+)	+	+	+	(+)	+	+	+	(+)	+	+	+	++
	-	++	+	(+)(+)	-	++	+	(+)(+)	-	+	+	(+)(+)	-	+	+	+
	-	++	-	(+)	-	+	-	(+)	-	+	-	(+)	-	+	-	+
8 <sup>th</sup>	(+)	++	+	(+)	+	+	+	(+)	+	+	+	(+)	+	+	+	(+)(+)
	-	++	+	(+)(+)	-	++	+	(+)(+)	-	+	+	(+)(+)	-	+	+	(+)(+)
	-	++	-	(+)	-	+	-	(+)	-	+	-	(+)	-	+	-	(+)
9 <sup>th</sup>	(+)	++	+	(+)	+	+	+	(+)	+	+	+	(+)	+	+	+	(+)(+)
	-	++	+	(+)(+)	-	++	+	(+)(+)	-	+	+	(+)(+)	-	+	+	(+)
	-	++	-	(+)	-	+	-	(+)	-	+	-	(+)	-	+	-	(+)
10 <sup>th</sup>	(+)	+	+	(+)	+	+	+	(+)	+	+	+	(+)	+	+	+	(+)
	(+)	++	+++	(+)(+)	-	++	++	(+)(+)	-	++	+++	(+)(+)(+)	-	++	+++	(+)(+)(+)
	-	-	-	(+)	-	-	-	(+)	-	-	-	(+)	-	-	-	(+)(+)
11 <sup>th</sup>	(+)	+	+	(+)	+	+	+	(+)	+	+	+	(+)	+	+	+	(+)
	(+)	++	+++	(+)(+)	-	++	++	(+)(+)	-	++	+++	(+)(+)(+)	-	++	+++	(+)(+)(+)
	-	+	-	(+)(+)	-	+	-	(+)	-	+	-	(+)	+	+	-	(+)(+)
12 <sup>th</sup>	(+)	+	+	(+)	+	+	+	(+)(+)	+	+	+	(+)	+	+	+	(+)
	(+)	++	+++	(+)(+)	-	++	+++	(+)(+)(+)	-	++	+++	(+)(+)(+)	-	++	+++	(+)(+)(+)
	-	+	-	(+)(+)	-	+	-	(+)	-	+	-	(+)	+	+	-	(+)(+)
13 <sup>th</sup>	(+)	+	++	(+)	+	+	+	(+)(+)	+	+	++	(+)	-	+	+	(+)
	(+)	++	+++	(+)(+)(+)	-	++	+++	(+)(+)(+)	-	++	+++	(+)(+)(+)	-	++	+++	(+)(+)(+)
	-	+	-	(+)(+)	-	+	-	(+)	-	+	-	(+)	+	+	-	(+)(+)
14 <sup>th</sup>	(+)	+	++	(+)	+	+	+	(+)	+	+	++	(+)(+)	+	+	+	(+)
	(+)	++	+++	(+)(+)(+)	-	++	+++	(+)(+)(+)	-	++	+++	(+)(+)(+)	-	++	+++	(+)(+)(+)
	-	++	-	(+)(+)	-	+	-	(+)	-	+	-	(+)	+	+	-	(+)(+)

A = Sterilized seeds + sterilized soil.

B = Unsterilized seeds + sterilized soil

C = Sterilized seed sown in unsterilized soil with inoculated *Alternaria burnsii*D = Sterilized seed sown in unsterilized soil with inoculated *Fusarium oxysporum* f.sp. *cumini*.

- = no infection

+ = low infection

++ = moderate infection

+++ = maximum infection

No. of plants in each pot = 6

Replicates = 3

+ *Alternaria burnsii*(+) *Fusarium oxysporum* f.sp. *cumini*

**Table 2.** Occurrence of *A. burnsii* and *F. oxysporum* f.sp. *cumini* in different plant parts in under incubation test (Standard Blotter technique) in different categories of treatments.

Category of treatment	Age of plant in weeks	Root	Leaf	Stem	Seed
A	1 <sup>st</sup>	-	-	-	-
B		-	-	-	-
C		-	-	-	-
D		-	-	-	-
A	2 <sup>nd</sup>	-	-	-	-
B		-	-	-	-
C		-	-	-	-
D		-	-	-	-
A	3 <sup>rd</sup>	-	+	+	-
B		-	+	+	-
C		-	+	-	-
D		-	-	-	-
A	4 <sup>th</sup>	-	+	-	-
B		-	+	+	-
C		-	++	++	-
D		-	-	-	-
A	5 <sup>th</sup>	-	-	-	-
B		-	++	+	-
C		-	++	++	-
D		+	-	-	-
A	6 <sup>s</sup>	-	+	+	-
B		-	++	++	-
C		-	++	++	-
D		+	-	-	-
A	7 <sup>th</sup>	-	++	++	++
B		-(+)	++	++	++
C		-	+++	-	-
D		+	-	-	-
A	8 <sup>th</sup>	-	++	++	+
B		-(+)	++	++	++
C		-	+++	-	++
D		+	-	-	-
A	9 <sup>th</sup>	-(+)(+)	+	++	+
B		-	++	++	++
C		-	++	-	+
D		+	++	-	+
A	10 <sup>th</sup>	+(+)(+)	++	+(+)	++
B		+(+)(+)	++	+(+)	++
C		-	+	++	+
D		++	+	++	+
A	11 <sup>th</sup>	-	+	++	+
B		-(+)(+)	++	+++(+)(+)	++
C		-	++	++	++
D		++	++	++	+
A	12 <sup>th</sup>	+	+	+	++
B		-(+)(+)(+)	++	+++(+)(+)	++(+)
C		-	++	++	++
D		++	++	++	++
A	13 <sup>th</sup>	-	++	+	++
B		-(+)(+)(+)	++	+++(+)(+)	+++(+)+
C		-	+++	++	++
D		++	+++	++	++
A	14 <sup>th</sup>	+	++	+	+
B		+(+)(+)(+)	+++	+++(+)(+)	+++(+)(+)
C		-	+++	+++	+++
D		++	+++	+++	+++

A = Sterilized seeds + sterilized soil.

B = Unsterilized seeds + sterilized soil

C = Sterilized seed sown in unsterilized soil with inoculated *Alternaria burnsii*

D = Sterilized seed sown in unsterilized soil with inoculated *Fusarium oxysporum* f.sp. *cumini*.

- =no infection

+ = low infection

++ = moderate infection

+++ = maximum infection

No. of plants in each pot = 6

Replicates = 3

+ *Alternaria burnsii*

(+) *Fusarium oxysporum* f.sp. *cumini*



Table 3. Isolation of *Alternaria burnsii* and *F. oxysporum cumini* on potato dextrose agar (PDA).

Age of plants in Weeks	Parts of Plant	A Sterilized seeds sown in Sterilized soil	B Unsterilized seed sown in Sterilized soil	C Seed sown in unsterilized soil with <i>Alternaria burnsii</i>	D Seed sown in unsterilized soil with <i>Fusarium oxysporum</i> f. sp. <i>cumini</i>
1 <sup>st</sup>	Leaf	-	-	-	-
	Stem	-	-	-	-
	Seed	-	-	-	-
	Root	-	-	-	-
2 <sup>nd</sup>	Leaf	-	-	-	-
	Stem	-	-	-	-
	Seed	-	-	-	-
	Root	-	-	-	-
3 <sup>rd</sup>	Leaf	-	-	+	-
	Stem	-	+	+	-
	Seed	-	-	-	-
	Root	-	-	-	-
4 <sup>th</sup>	Leaf	-	-	++	-
	Stem	-	+	+	-
	Seed	-	-	-	-
	Root	-	-	-	-
5 <sup>th</sup>	Leaf	-	-	++	-
	Stem	-	++	++	-
	Seed	-	-	-	-
	Root	-	-	-	-
6 <sup>th</sup>	Leaf	+	++	++	-
	Stem	-	-	++	-
	Seed	-	-	-	-
	Root	-	-	-	(+)
7 <sup>th</sup>	Leaf	+	++	+	(+)
	Stem	-	-	-	-
	Seed	-	-	-	(+)
	Root	-	-	-	-
8 <sup>th</sup>	Leaf	+	+	++	(+)
	Stem	-	++	+	-
	Seed	-	-	-	-
	Root	-	-	-	(+)
9 <sup>th</sup>	Leaf	+	+++	+++	(+)
	Stem	-	++	+++	(+)
	Seed	-	-	-	(+)
	Root	-	-	-	(+)
10 <sup>th</sup>	Leaf	+	+++	+++	(+)(+)
	Stem	-	++	++	(+)
	Seed	-	+	-	(+)
	Root	-	-	-	(+)

Contd...

Contd.

11 <sup>th</sup>	Leaf	++	+++	+++	(+)(+)
	Stem	-	++	+++	(+)
	Seed	-	+	-	-
	Root	-	-	+	(+)
12 <sup>th</sup>	Leaf	++	+++	+++	(+)(+)
	Stem	-	+++	+++	(+)(+)
	Seed	-	++	-	-
	Root	-	-	-	(+)(+)
13 <sup>th</sup>	Leaf	++	+++	+++	(+)(+)
	Stem	-	+++	+++	(+)(+)(+)
	Seed	-	++	++	-
	Root	-	-	-	(+)(+)
14 <sup>th</sup>	Leaf	++	+++	+++	(+)(+)
	Stem	-	+++	+++	(+)(+)(+)
	Seed	-	++	++	-
	Root	-	-	-	(+)(+)(+)

- =no infection                      +++ = maximum infection  
 + = low infecton                    + *Alternaria burnsii*  
 ++ = moderate infection            (+) *Fusarium oxysporum* f.sp. *cumini*

*oxysporum* f.sp. *cumini*; when inoculum was added in the soil, the disease incidence was very high.

In the present investigation the percent-incidence of *A. burnsii* was found more on unsterilized seed as compare to sterilized seed. These findings are in conformity with the previous findings of Gemawat<sup>4</sup>. The percentage of pathogen was more in case of agar plate method than in blotter method. These findings closely resemble that of Champawat and Pathak<sup>8</sup>.

Mathur and Mathur<sup>5</sup> during their investigation on wilt of cumin had observed *Alternaria* in a few soil samples taken from wilt sick fields. It shows that soil carried *Alternaria* spore together with other microorganisms. Production of blight symptoms in cumin plants raised in soils infested with *Alternaria* suggested that soil also played a role in survival of the pathogen year after year.

In our second investigation the percent incidence of *Fusarium oxysporum* f. sp. *cumini* found more on unsterilized soil as compared to sterilized soil. These findings are in concurrence with the previous finding of Mathur and Mathur<sup>5</sup>. In our investigation the pathogen was also found in unsterilized seed and sterilized soil. These findings are in conformity with the previous finding of Edison<sup>9</sup> who reported the fungus to be soil borne and internally seed borne.

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