

*Trichoderma viride*

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**Abstract**

The antagonistic ability tests of the biocontrol agent *Trichoderma viride* against pathogenic fungi, indicated a high inhibiting effect on the growth of two isolates of *Fusarium solani* and *Rhizoctonia solani* with moderate degree of antagonism and weak with *Macrophomina phaseolina*. The effect of the fungal polysaccharide produced by *Alternaria alternata* on the radial growth of pathogenic fungi and the biocontrol agent showed that the relatively high concentrations (i.e. 4 and 5 gm/l) reduced their growth slightly, but stimulated the development of spores of *Trichoderma viride* simultaneously and increased their numbers. Seed treatment with spore suspension of *T. viride* cause significant reduction in infection percentage and disease severity of both pre and post emergence seedlings damping-off, and led to an increase in seedling length and dry weight of the seedlings in pot experiments. The addition of adhesive material (i.e. Fungal polysaccharide or gum Arabic) to the seeds increased the reduction in infection percentage and degree of severity of the disease, and also increased length and dry weight of the seedling. The microbial polysaccharide was better than gum arabic in controlling the disease, although no significant differences were noticed between them. Moreover, it improved growth characters of the plants.

**Key words :** Microbial polysaccharide, Damping-off, Okra

*Trichoderma viride*

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*solani Fusarium solani*

*Macrophomina phaseolina*

*Rhizoctonia*

*Alternaria alternata*

( / 5 4)

)

(

(1)

.(2)

.(3)

Intercellular

Extracellular

*Alternaria alternata* .(4)

Heteropolysaccharide

(6-1) $\beta$

(3-1) $\beta$

25

$(\alpha)^{20}L = -47$

$.[N] = 1.9$

$.(\%1.0)$

$(\%0.31)$

$(\%1.5)$

$(\%97.5)$

$.(5)$

$(\%0.41)$

*Trichoderma viride*

*A. alternata*

*Trichoderma viride*

*M. phaseolina* (6)

*R. solani* *F. solani*

( 9)

(PSA)

( 5)

*F. solani*

*M. phaseolina*

*R. solani*

(7-3)

( 1± 27)

=1 (7)

=4

2/1

=3

3/2

=2

=5

3/2

(2)

*Alternaria alternata*

*Alternaria aternata*

(5)

.(PSA)

( / 1.5) ( / 40) : *A. alternata*

( / 0.5)

( / 3.5)

.(6.0)

( / 2.0)

( 100)

( 250)

.(5) ( 15<sup>2</sup> / 15 120 )

( 4)

( 7) PSA

. ( 7) ( 1± 27)

(8)

( 15) ( / 9000) Centerfugation

.( 5)

( / 9000)

Centerfugation

( 24) ( 50)

/ (5 4 3 2 1 0) (PSA)

( 9)

( 5 )

(PSA)

( )

( 1 ± 27)

. 1±27

( 5)

10

.Haemocytometer

*Trichoderma viride*

*T. viride*

( )

*A. aternata*

*T. viride*

( / 3)

*T. viride*

( / <sup>8</sup>10)

( / 5)

/ 12

%1

:

.1

.2

.3

.( ) .4

.5

.6

(CRD)

/

%100\*(10)

%.%100\*(10)

(2)

(1)

(3-0)

...

**Trichoderma viride**

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$$\frac{\begin{matrix} \times & & + \dots + & & \times \\ \times & & + \dots + & & \times \end{matrix}}{\times 10} =$$

.(10) 0.05

***T.viride***

*T.viride*

(2)

(7)

.(3)

*R.solani* *F.solani*

*M.phaseolina*

*T.viride*

*T.harzianum*  
(hyphal coils)

(11 3)

*R.solani*

.(appressoria)

(hooks)

(12) Gliotoxin Viriden

Emodin Pachybasin Chrysophanol

(13) Proteinase

Chitinase

.(16 15 14)

***Alternaria alternata***

***T. viride***

(1)

*M.phaseolina*

/ 2 1

&

/ 2  
8.20 8.27

*F.solani*  
*R.solani F.solani*

*T.viride*

(16)

*Xanthomonas campestris*

*P.aphanidermatum F.solani M. phaseolina*

*Trichoderma*

spp.

(17)

*M. phaseolina*

:(1)

.\*( ) *T. viride*

*R.solani F. solani*

( / )							
	5.0	4.0	3.0	2.0	1.0	0.0	
B 8.04	I 7.17	G 7.57	E 8.0	A 8.50	A 8.50	* A 8.50	<i>M. phaseolina</i>
C 7.98	J 7.0	G 7.57	D 8.07	B 8.27	A 8.50	A 8.50	<i>F. solani 1</i>
D 7.55	K 6.17	H 7.47	E 8.0	A 8.50	A 8.50	A 8.50	<i>F. solani 2</i>
E 7.78	L 6.0	F 7.70	E 8.0	C 8.20	B 8.30	A 8.50	<i>R. solani</i>
A 8.15	H 7.50	D 8.10	A 8.50	A 8.50	B 8.30	E 8.0	<i>T. viride</i>
X	A 4.70	A 5.12	A 4.75	B 4.13	C 3.33	C 3.19	( <sup>8</sup> 10 *)

0.05

*T.viride*

...

**Trichoderma viride**

(16)

*Xanthomonas campestris*

*P.aphanidermatum F.solani M. phaseolina*

*.Trichoderma*

spp.

(17)

***T. viride***

) (2 )

(

*T. viride*

*F. solani*

.( %53.33 26.67)

) ***T. viride*** :(2)

.\*

(

%						
		<i>R. solani</i>	<i>F. solani 2</i>	<i>F. solani 1</i>	<i>M. phaseolina</i>	
A 42.67	ABC 46.67	D-G G30	AB 50.00	A-E 40.00	ABC 46.67	
A 40.67	ABC 46.67	C-F 33.33	A-D 43.33	C-F 33.33	ABC 46.67	
A 42.66	A-D 43.33	C-F 33.33	A 53.33	A-E 40.00	A-D 43.33	
C 24.67	C-F 33.33	FJ 23.33	G 16.67	FG 23.33	EFG 26.67	
BC 32.73	B-F 36.67	EFG 26.67	FG 23.33	EFG 46.67	D-G 30.33	
B 27.93	A 40.00	B-F 36.67	EFG 26.67	D-G 30.00	C-F 33.33	
	A 41.11	C 30.56	BC 35.56	C 32.22	AB 37.78	%

0.05

\*



*F. solani*

*Trichoderma*

*R. solani*

(20) .(19 18 14

*T. harzianum*

(21)

*T. harzianum*

(22)

*T. hamatum*

*T. harzianum*

*Pythium ultimum*

(23)

Seed exudates

Propagules

*T. viride*

*R. solani F. solani M. phaseolina*

*T. viride*

*F. M. phaseolina*

*solani*

.(3 )

)

*T. viride*

:(3)

*M. phaseolina*

(

.\* *R. solani F. solani*

		<i>R. solani</i>	<i>F. solani 2</i>	<i>F. solani 1</i>	<i>M. phaseolina</i>		
A 5.334	A 53.33	B-E 40.00	ABC 46.67	A-D 43.33	A-D 43.33		
A 45.33	A 53.33	B-E 40.00	AB 50.00	B-E 40.00	A-D 43.33		
A 45.33	AB 50.00	B-E 40.00	ABC 46.67	A-D 43.33	ABC 46.67		
C 16.67	F-I 26.67	K 10.00	K 10.00	JK 13.33	G-J 23.33		
C 20.00	E-H 30.00	JK 13.33	JK 13.33	IJK 16.67	F-I 26.67		
B 25.33	C-F 36.67	H-K 0.00	G-J 23.33	D-G 33.33	D-G 33.33		
	A 41.67	D 27.22	C 31.67	C 31.67	B 36.11	%	

0.05

...

**Trichoderma viride**

( )  
 % 23.33  
*R.solani* *F. solani* *M. phaseolina* %13.33  
 % 33.33 % 33.33)  
 (24) .( % 0.0 % 23.33  
*T. pseudokoningii*  
 (16) *M.phaseolina*  
*T. harzianum* *T. viride*

***T. viride***

***R. solani* *F. solani* *M. phaseolina***

(4)  
 ( )

) ***T. viride*** :(4)

.\*

(

		<i>R. solani</i>	<i>F. solani</i> 2	<i>F. solani</i> 1	<i>M. phaseolina</i>		
A 0.74	A 0.74	D-G 0.55	A-D 0.68	B-F 0.59	*A-D 0.68		
A 0.65	A 0.74	B-G 0.57	ABC 0.69	B-G 0.58	ABC 0.69		
A 0.65	A 0.73	C-G 0.56	AB 0.70	A-E 0.62	A-D 0.68		
D 0.28	G-J 0.46	ML 0.20	M 0.17	KLM 0.26	JK 0.34		
C 0.43	D-G 0.55	KLM 0.27	ML 0.20	KL 0.30	HK 0.39		
B 0.46	A-D 0.64	JK 0.34	IJK 0.35	F-I 0.48	E-H 0.49		
	A 0.64	D 0.41	C 0.46	C 0.47	B 0.54		

0.05

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**Trichoderma viride**

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*T. viride*

0.104

0.164

18.38

*R. solani*

(24 16)

*T.viride*

.(27 26)

( ) ( ) *T. viride* : (5)  
 . \* *R. solani* *F. solani* *M. phaseolina* ( )

( )					( )					
	<i>R. solani</i>	<i>F. solani 2</i>	<i>F. solani 1</i>	<i>M. phaseolina</i>		<i>R. solani</i>	<i>F. Solani2</i>	<i>F. solani 1</i>	<i>M. phaseolina</i>	
G 0.042	FG 0.053	FG 0.050	FG 0.051	FG 0.049	I 4.85	HI 6.19	I 5.75	I 5.93	I 5.61	
G 00.042	FG 0.053	FG 0.050	FG 0.051	FG 0.049	I 4.83	HI 6.18	I 5.73	I 5.90	I 5.61	
G 0.042	FG 0.053	FG 0.050	FG 0.051	FG 0.048	I 4.81	HI 6.17	I 5.73	I 5.91	I 5.60	
B 0.127	A 0.164	B 0.142	B 0.140	B 0.130	F 12.67	A 18.38	B 16.26	B 16.11	BC 15.99	
CD 0.089	B 0.140	B 0.132	B 0.128	B 0.122	G 10.59	BC 15.71	F 12.62	CDE 14.41	DEF 13.46	
CD 0.088	C 0.104	CD 0.092	DE 0.083	F 0.069	H 7.71	CF 12.92	CDE 9.17	F 12.28	FG 11.85	
D 0.073	A 0.094	B 0.086	BC 0.084	CD 0.078	C 7.57	A 10.92	B 10.16	B 10.09	B 9.69	

0.05

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