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Studies on factors affecting *Rhizoctonia bataticola* VIII. Fungal culture filtrate

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The culture filtrates of fourteen fungi namely, *Alternaria alternata* (Fr.) Kriessler, *Curvularia pallescens* Boedijn, *Drechslera specifera* (Bainier) Boedijn, *Fusarium oxysporum* Schlecht from gram, *Fusarium oxysporum* Schlecht from barnyard millet, *Aspergillus nidulans* (Eidam) Winter, *Penicillium* sp., *Rhizoctonia solani* Kuhn, *Sporotrichum* sp. and five *Trichoderma viride* strains (Tv-1, Tv-2, Tv-3, Tv-4 and Tv-5) were screened *in vitro* against isolates of *Rhizoctonia solani* Kuhn, *Sporotrichum* sp. and five *Trichoderma viride* strains (Tv-1, Tv-2, Tv-3, Tv-4 and Tv-5) were screened *in vitro* against isolates of *Rhizoctonia bataticola* (Rb 1, Rb 2, Rb 3, Rb 4, Rb 5, Rb 6 and Rb 7). The culture filtrates of all the fungi significantly inhibited the mycelial growth except of *A. alternata, Sporotrichum* sp., Tv-4, Tv-2 and Tv-3 strains of *T. viride*. Sclerotia with variously reduced size, poorly produced and coalesced were observed in affected isolates.

Key words : Culture filtrates, growth, sclerotia formation, *Rhizoctonia bataticola*

INTRODUCTION

Efforts to control *Rhizoctonia bataticola,* a soil inhabiting pathogen having a wide host range have not been largely successful so far. From time to time, through *in vitro* tests, several potential fungal antagonists have been reported (Ghaffar, 1968). Because *R. bataticola* a soil inhabiting fungus so it interacts with various microorganisms in soil. It must interacts with other soil fungi or soil fungi must have interaction (stimulatory or antagonistic) with *R. bataticola*. With this in view, this experiment has been carried out under *in vitro* condition to study the effect of the culture filtrates of fourteen fungi at different concentrations on the growth and production of sclerotia of seven isolates of *R. bataticola*.

MATERIALS AND METHODS

Fourteen fungi viz., *Alternaria alternata* (Fr.) Kriessler, *Curvularia pallescens* Boedijn, *Drechslera specifera* (Bainier) Boedijn, *Fusarium oxysporum* Schlecht from gram, *Fusarium oxysporum* Schlecht from Barnyart millet, *Aspergillus nidulans* (Eidam) Winter, *Penicillium* sp., *Rhizoctonia solani* Kuhn, *Sporotrichum* sp. and five *Trichoderma viride* strains (Tv-1, Tv-2, Tv-3, Tv-4 and Tv-5) were used for production of culture filtrates. These fungi were grown on Richards broth for 15 days at room temperature in 500 ml conical flasks containing 200 ml broth, inoculated with 3 discs of 8 mm diameter from the margins of seven days old cultures of the fungi. The cultures were filtered through Whatman's filter paper No. 42 into sterilized flasks under aseptic condition. These culture filtrates were partially sterilized (boiled at 100°C for 5-7 minutes) and used for *in vitro* studies against seven isolates of *R. bataticola*. The culture filtrates were added separately and aseptically in molten sterilized Asthana & Hawker's medium, in hot condition so as to get 25 and 75 per cent concentrations. The basal medium was initially incorporated with extra amount of agar and other constituents for the resultant volume made after dilution with culture filtrates. The medium without culture filrate seved as control. The amended media were poured in sterilized Petridishes in triplicate for each treatment. Each

plate was inoculated centrally by transferring an 8 mm disc from the margins of seven days old cultures of *R. bataticola* isolates and inoculated plates were incubated at 29±1ºC. The observations for growth and morphological characters of selerotia were recorded on 3rd and 5th day of incubation.

RESULTS AND DISCUSSION

It is evident from the results shown (Table 1; Figs. 1, 2, 3, 4, 5 & 6) that generally the adverse effects of culture filtrates on the isolates were increased with increase in concentration. The sensitivity of the isolates was also found to vary in different culture filtrates. Culture filtrates of *Fusarium oxysporum* (gram) and *F. oxysporum* (barnyard millet) were found to inhibit the radial growth of isolates at both the concentrations. No or little growth was observed in isolates Rb 1, Rb 4 Rb 5 and Rb 6 in culture filtrate of *F. oxysporum* (barnyard millet). Sclerotia with much reduced size, coalesced and poorly produced were observed in both the filtrates. The results are in agreement with Singh and Kaiser (1996) who showed that *Fusarium solani* f. sp. *psidii* inhibited linear growth and reduced sclerotial production of *Macrophomina phaseolina.* Siddiqui and Hussain (1991) reported effectiveness of culture filtrate of *Fusarium solani* against *M. phaseolina.*

Growth only over the disc in the isolates was observed at 75% concentration of *A. nidulans.* Inhibition of growth, sclerotial germination and sclerotial production by culture filtrates of *Aspergillus* sp. were also reported by Pandey (1985); Gajbe and Lanjewar (1991); Siddiqui and Hussain (1991) and Pineda and Gonnella (1988). Similar effectiveness of culture filtrate of *Penicillium* sp. on *Macrophomina phaseolina* were reported by Mukherjee and Sen (1992). The *Penicillium* and *Aspergillus* sp. acted through antibiosis or as a competitor of the fungus at the infection court (Cook and Baker, 1983).

Out of five *Trichoderma viride* strains culture filtrates of Tv-1 and Tv-5 were found more efficient in inhibiting the growth, sclerotial formation and sclerotial size of isolates of *R. bataticola.* Culture filtrates of Tv-1, and Tv-5 caused cent per cent mycelial growth inhibition in isolates Rb 4 and Rb 5; and Rb 7, respectively at 75 per cent concentration. The result was further supported by the findings of Pandey (1985), Rettinassababady *et al.* (2000), Ushamalini *et al.* (1997) and Jeyarajan (1996) reported inhibition of growth, sclerotial size and formation by *Trichoderma viride.*

The pronounced effect on inhibition of growth, sclerotial size and production by *Trichoderma viride* strains Tv-1 and Tv-5, might be due to higher production of antibiotic substances in liquid culture by *T. viride* as reported by Lebed *et al.* (1978), whereas Velikanov *et al.* (1994) observed a reversed correlation between hyperparasitic and antibiotic activity of *Trichoderma* sp. against *M.phaseolina.*
Culture filtrate of *Alternaria alternata* was found to promote the growth of all the isolates, but a little reduction in the sclerotial size was found at 25% concentration. Siddiqui and Hussain (1991) reported effectiveness of undiluted culture filtrates of *Alternaria brassicicola and A. triticina against M. phaseolina.*

Culture filtrates of *Drechslera specifera* and *Rhizoctonia solani* significantly inhibited growth, sclerotial production and sclerotial size of all the isolates of *R. bataticola.* Higher concentrations of *D. specifera* and *R. solani* were totally inhibited the mycelial growth of the isolates Rb 3 and Rb 6; and Rb 1, Rb 3, Rb 4, Rb 6 and Rb 7, respectively. No growth in all the isolates was recorded at any concentration of culture filtrate of *Curvularia Pallescens.* The filtrate was found most effective among the other culture filtrates tested. There might be certain antagonistic metabolite produced by *Alternaria alternata, Drechslera specifera, Curvularia pallescens and R. Solani* that was responsible for the above effects.

According to Dubey and Dwivedi (1988) the inhibition of growth, sclerotial production and size may be attributed to secretion of some toxic metabolites by these fungi, which resulted into colony growth inhibition, coagulation of cytoplasm, hyphal discolouration and dissolution of hyphae of *M. phaseolina.* In general the effect of antagonists on sclerotial size is a naturally corollary to the inhibition of mycelial growth in view of the fact that the reserve food material in mature sclerotia is to be supplied by vegetative hyphae. When the growth of vegetative hyphae itself inhibited, it is not able to supply adequate amount of reserve food for the developing sclerotium. This agrees with findings of Phillips (1986) with *Gliocladium virens,* which parasitized and decayed sclerotia of *M. phaseolina in vitro.*

Table 1 : Effect of fungal culture filtrates on the morphological characters of differenct isolates of *R. bataticola*

Org.	Isolate	Con (%)	Colony Pattern/ Margin	Hyphae Pattern/ Colour	L x W (m)	Sclerotia Size/ Shape	Pattern/ Initiation	Colour
1	2	3	4	5	6	7	8	9
Control	Rb1	Nil	Appr//Even	Dn/LB to B	11.29 x 101.72	Md/R to O	Dn/Ely	Bl
	Rb2		Flocc/Wavy	Dn/B	116.47 x 93.31	Md/R to O	Dn/Ely	Bl
	Rb3		Flocc/Wavy	Dn/LB to B	88.62 x 75.92	Small/R to O	Sp/Ely	Bl
	Rb4		Appr/.Even	Sp/LB to B	132.69 x 112.06	Large/R to O	Dn/Ely	Bl
	Rn5		Flocc/Wavy	Dn/LB	105.34 x96.22	Md/R to O	Dn/Ely	Bl
	Rb6		Appr/.Even	Dn/LB to B	112.26 x 111.38	Md/Irre	Dn/Ely	Bl
	Rb7		Flocc/Wavy	Dn/B	90.53 x 79.70	Md/R to O	Sp/Ely	DB
Aspergillus nidulans	Rb1	25	Appr/.Wavy	Sp/H. to LB	72.31 x 67.84	Small/R to O	Sp/Dly	Bl
	Rb2		Flocc/Wavy	Dn/B	72.56 x 65.22	Small/R to O	Dn/Ely	DB
	Rb3		Flocc/Irre	Dn/B	65.00 x 55.87	Small/D	Sp/Dly	B
	Rb4		Appr/.Irre	Sp/H. to LB	78.81 x 73.93	Small/R to O	Dn/Ely	B
	Rb5		Flocc/Irre	Dn/LB	77.84 x65.25	Small/R to O	Sp/Ely	DB
	Rb6		Appr/.Wavy	Dn/LB	75.56 x 67.43	Small/R to O	Dn/Ely	Bl
	Rb7		Flocc/Irre	Dn/B	90.53 x 79.70	Md/R to O	Sp/Ely	DB
	Rb1	75	—	—	—	—	—	—
	Rb2		—	—	—	—	—	—
	Rb3		—	—	—	—	—	—
	Rb4		—	—	—	—	—	—
	Rb5		—	—	—	—	—	—
	Rb6		—	—	—	—	—	—
	Rb7		—	—	—	—	—	—
Alternaria alternata	Rb1	25	Flocc/Irre	Sp/H. to LB	72.31 x 67.84	Small/Irre	Dn/Ely	Bl
	Rb2		Flocc/Wavy	Sp/H. to LB	87.75 x 82.46	Small/R to O	Sp/Ely	Bl
	Rb3		Cottony Wavy	Sp/H. to LB	53.62 x47.12	Small/R to O	Sp/Ely	DB
	Rb4		Appr//Irre	Sp/H	81.65 x 78.40	Small/R to O	Dn/Ely	Bl
	Rb5		Flocc/Wavy	Sp/LB	88.56 x 77.59	Small/R to O	Sp/Ely	DB
	Rb6		Flocc/Wavy	Sp/H	78.00 x72.71	Small/R to O	Dn/Ely	DB
	Rb7		Cottony Wavy	Sp/B	74.03 x67.93	Small/Irre	Dn/Ely	Bl
	Rb1	75	Flocc/Irre	Sp/H. to LB	89.31 x 80.84	Small/Irre	Dn/Ely	Bl
	Rb2		Flocc/Wavy	Sp/H. to LB	97.09 x 91.00	Md/R to O	Sp/Ely	Bl
	Rb3		Cottony Wavy	Dn/LB	62.56 x 56.06	Small/Irre	Sp/Ely	DB
	Rb4		Appr/Irre	Sp/H	100.34 x 88.96	Md/Irre	Dn/Ely	Bl
	Rb5		Flocc/Wavy	Dn/B	100.39 x 88.56	Md/R to O	Dn/Ely	Bl
	Rb6		Flocc/Wavy	Sp/B	87.34 x 77.59	Small/R to O	Dn/Ely	Bl
	Rb7		Cottony Wavy	Sp/B	82.87 x 75.15	Small/Irre	Dn/Ely	Bl
Curvularia pallescens	Rb1	25	—	—	—	—	—	—
	Rb2		—	—	—	—	—	—
	Rb3		—	—	—	—	—	—
	Rb4		—	—	—	—	—	—
	Rb5		—	—	—	—	—	—
	Rb6		—	—	—	—	—	—
	Rb7		—	—	—	—	—	—
	Rb1	75	—	—	—	—	—	—
	Rb2		—	—	—	—	—	—
	Rb3		—	—	—	—	—	—
	Rb4		—	—	—	—	—	—
	Rb5		—	—	—	—	—	—
	Rb6		—	—	—	—	—	—
	Rb7		—	—	—	—	—	—

(Continued)

1	2	3	4	5	6	7	8	9
Drechslera specifera	Rb1		Appr/.Irre	Dn/LB to B	79.62 × 69.87	Small/R to O	Dn/Ely	Bl
	Rb2		Flocc/Irre	Sp/L Bl	103.18 ×91.40	Md/R to O	Dn/Ely	Bl
	Rb3		Flocc/Irre	Dn/B	67.43 × 58.90	Small/R to O	Dn/Ely	Bl
	Rb4	25	Appr/.Irre	Dn/L Bl	127.67 × 106.78	Large/R to O	Dn/Ely	DB
	Rn5		Flocc/Irre	Dn/L B	93.43 × 81.25	Md/R to O	Sp/Ely	Bl
	Rb6		Appr/Irre	Dn/L Bl	98.82 × 83.51	Md/Irre	Bl	Bl
	Rb7		Cottony/Irre	Dn/B	112.35 × 94.23	Md/Irre	Dn/Ely	DB
	Rb1		Appr/Irre	Dn/B	114/56 × 99.12	Md/Irre	Sp/Ely	Bl
	Rb2		Flocc/Irre	Dn/B	91.00 × 82.87	Md/O to E	Dn/Ely	Bl
	Rb3		—	—	—	—	—	—
	Rb4	75	Appr/.Irre	Sp/B	98.31 × 88.56	Md/R to O	Dn/Dly	Bl
	Rb5		Flocc/Wavy	Dn/LB	59.09 × 54.65	Small/D	Sp/Ely	B
	Rb6		—	—	—	—	—	—
	Rb7		Cottony/Wavy	Dn/B	105.51 × 85.11	Md/Irre	Sp/Dly	DB
1. *Fusarium oxysporum* (gram)	Rb1		Appr/.Irre	Dn/H to LB	72.31 × 67.43	Small/Irre	Dn/Dly	B
	Rb2		Flocc/Irre	Sp/LB to B	55.25 × 52.00	Small/Irre	Dn/Dly	DB
	Rb3		Flocc/Wavy	Dn/H to LB	40.23 × 35.49	V. Small/Irre	Dn(c)*/Ely	B
	Rb4	25	—	—	—	—	—	—
	Rb5		Flocc/Even	Dn/B	(c)	—	Dn(c)/Ely	DB
	Rb6		—	—	—	—	—	—
	Rb7		Flocc/Irre	Sp/L B	27.08 × 21.66	V. Small/Irre	Dn(c)/Ely	DB
	Rb1		—	—	—	—	—	—
	Rb2		Appr/Irre	Sp/B	57.58 × 55.16	Small/D	Dn/Dly	B
	Rb3		Cottony/Irre	Dn/LB to B	30.25 × 28.29	V. Small/D	Dn(c)*/Ely	B
	Rb4	75	—	—	—	—	—	—
	Rb5		—	—	—	—	—	—
	Rb6		—	—	—	—	—	—
	Rb7		Flocc/Wavy	Dn/B	32.50 × 32.50	V. Small/D	Dn/Ely	B
2. *Fusarium oxysporum* (tar myad millet)	Rb1		Appr/.Irre	Dn/B	58.09 ×54.84	Small/Irre	Dn(c)*/Dly	B
	Rb2		Flocc/Wavy	Dn/B	77.59 × 72.31	Small/Irre	Dn(c)*/Dly	DB
	Rb3		Flocc/Irre	Dn/B	51.18 × 45.09	Smll/Irre	Dn(c)*/Ely	Bl
	Rb4	25	Appr/Abrupt	Dn/B	87.75 × 82.66	Small/Irre	Dn/Ely	DB
	Rb5		Flocc/Abrupt	Dn/B	60.12 × 54.43	Small/Irre	Dn/Ely	DB
	Rb6		Flocc/Wavy	Dn/B	70.28 × 60.12	Small/Irre	Dn(c)*/Ely	DB
	Rb7		Flocc/Irre	Sp/H	49.06 × 42.37	V. Small/Irre	Dn(c)*/Ely	B
	Rb1		—	—	—	—	—	—
	Rb2		Flocc/Irre	Dn/B	82.87 × 79.75	Small/Irre	Dn(c)*/Ely	DB
	Rb3		Flocc/Irre	Dn/B	36.56 × 32.50	V. Small/Irre	Dn(c)*/Ely	Bl
	Rb4	75	—	—	—	—	—	—
	Rb5		Flocc/Irre	Dn/L B	42.50 × 38.37	V. Small/Irre	Dn(c)*/Ely	DB
	Rb6		Flocc/Irre	Dn/B	52/36 × 43.06	Small/Irre	Dn(c)*/Ely	DB
	Rb7		Flocc/Irre	Dn/LB	48.52 × 40.29	V. Small/Irre	Dn(c)*/Ely	Bl
Rhizoctonia solani	Rb1		Appr/.Irre	Dn/LB	92.62 ×85.31	Md/Irre	Dn/Ely	Bl
	Rb2		Appr/Even	Dn/L Bl	103.59 × 89.37	Md/Irre	Dn/Ely	Bl
	Rb3		Cottony Wavy	Dn/B	70.03 × 60.59	Small/R to O	Sp/Ely	Bl
	Rb4	25	Appr/.Irre	Dn/L Bl	103.18 × 95.06	Md/Irre	Dn(c)/Dly	DB
	Rb5		Flocc/Wavy	Dn/B	91.80 × 80.43	Md/R to O	Dn/Ely	Bl
	Rb6		Appr/.Irre	Dn/B	90.06 × 78.55	Md/Irre	Dn(c)*/Dly	Bl
	Rb7		Cottony Wavy	Dn/B	115.33 × 97.89	Md/Irre	Dn/Dly	Bl
	Rb1		—	—	—	—	—	—
	Rb2		Appr/.Irre	Dn/L Bl	102.69 × 87.63	Md/Irre	Dn(c)*/Dly	Bl
	Rb3		—	—	—	—	—	—
	Rb4	75		—	—	—	—	—
	Rb5		Flocc/Irre	Dn/B	90.25 × 78.27	Md/R to O	Dn/Ely	Bl
	Rb6		—	—	—	—	—	—
	Rb7		—	—	—	—	—	—

(Continued)

1	2	3	4	5	6	7	8	9
Sporotrichum sp.	Rb1		Appr/.Irre	Dn/B	60.93 ×54.14	Small/R to O	Dn/Ely	Bl
	Rb2		Flocc/Irre	Dn/B	110.45 × 100.06	Md/Irre	Sp/Ely	Bl
	Rb3		Flocc/Irre	Dn/H to LB		No sclerotia		
	Rb4	25	Appr/.Even	Sp/H. to LB	105.08 × 88.83	Md/R to O	Dn/Ely	Bl
	Rn5		Flocc/Irre	Dn/L B	103.30 × 89.37	Md/R to O	Md/Ely	Bl
	Rb6		Appr/.Irre	Dn/B	100.00 × 85.00	Md/Irre	Dn/Ely	Bl
	Rb7		Flocc/Irre	Dn/LB to B	52.36 × 45.13	Small/R to O	Sp/Dly	Bl
	Rb1		Appr/.Irre	Dn/B	58.26 × 52.24	Small/Irre	Dn/Ely	Bl
	Rb2		Flocc/Irre	Dn/B	92.66 × 86.12	Md/R to O	Dn/Ely	Bl
	Rb3		Flocc/Irre	Dn/H to LB				
	Rb4	75	Appr/.Even	Sp/H. to LB	97.50 × 85.31	Md/R to O	Dn/Ely	Bl
	Rb5		Flocc/Irre	Dn/B	73.64 × 66.88	Small/R to O	Dn/Ely	Bl
	Rb6		Appr/.Irre	Dn/LB	102.37 × 91.76	Md/Irre	Dn/Ely	Bl
	Rb7		Flocc/Irre	Dn/LB to B	58.50 × 48.75	Small/Irre	Dn/Dly	Bl
Penicillium sp.	Rb1		Appr/.Irre	Dn/B	80.84 × 76.37	Small/Irre	Dn/Ely	DB
	Rb2		Flocc/Wavy	Dn/B	132.70 × 111.04	Large/Irre	Dn/Ely	Bl
	Rb3		Flocc/Irre	Dn/B	75.83 ×59.58	Small/R to O	Sp/Ely	Bl
	Rb4	25	Appr/Wavy	Sp/H. to LB	97.90 × 89.37	Md/Irre	Dn/Ely	Bl
	Rb5		Flocc/Irre	Dn/B	101.96 × 97.90	Md/R to O	Dn/Ely	DB
	Rb6		Flocc/Irre	Dn/B	70.53 × 65.25	Small/Irre	Dn(c)*/Ely	Bl
	Rb7		Flocc/Wavy	Sp/B	68.65 × 60.53	Small/Irre	Dn(c)*/Ely	DB
	Rb1		Appr/.Irre	Sp/B	101.56 × 84.50	Md/Irre	Dn(c)*/Ely	Bl
	Rb2		Flocc/Wavy	Dn/B	140.56 × 121.06	Large/Irre	Dn(c)*/Ely	Bl
	Rb3		Flocc/Irre	Dn/B	79.23 × 62.06	Small/Irre	Sp/Dly	Bl
	Rb4	75	Appr/.Irre	Dn/DB	104.80 × 88.56	Md/Irre	Dn/Ely	Bl
	Rb5		Flocc/Irre	Dn/B	107.25 × 95.05	Md/R to O	Dn/Ely	DB
	Rb6		Flocc/Irre	Dn/B	88.25 × 75.00	Small/Irre	Dn(c)*/Ely	Bl
	Rb7		Flocc/Wavy	Sp/B	90.15 × 74.75	Md/Irre	Dn(c)*/Ely	DB
Tv-1.	Rb1		Appr/.Irre	Sp/H. to LB	80.18 × 65.16	Small/Irre	Dn/Ely	B
	Rb2		Flocc/Irre	Sp/B	108.87 × 93.84	Md/Irre	Dn(c)*/Ely	Bl
	Rb3		Flocc/Irre	Dn/H	62.23 × 55.92	Small/D	Sp/Ely	DB
	Rb4	25	Appr/Even	Sp/H. to LB	89.06 × 74.18	Small/Irre	Dn(c)*/Ely	Bl
	Rb5		Flocc/Irre	Dn/B	86.93 × 82.06	Small/R to O	Dn/Ely	DB
	Rb6		Flocc/Wavy	Dn/B	69.00 ×59.71	Small/Irre	Dn/Ely	DB
	Rb7		Flocc/Irre	Dn/B	48.75 × 42.25	V. Small/R to O	Dn/Dly	LB
	Rb1		Appr/.Irre	Dn/H. to LB	59.09 × 52.00	Small/Irre	Dn/Dly	DB
	Rb2		Flocc/Wavy	Sp/B	82.49 × 71.50	Small/Irre	Dn(c)*/Ely	Bl
	Rb3		Flocc/Irre	Dn/B	56.87 × 48.75	Small/Irre	Dn(c)*/Ely	Bl
	Rb4	75	—	—	—	—	—	—
	Rb5		—	—	—	—	—	—
	Rb6		Flocc/Irre	Dn/B	(c)	—	Dn(c)/Ely	DB
	Rb7		Flocc/Irre	Dn/B	40.62 ×32.50	V. Small/Irre	Sp/Dly	DB
Tv-2.	Rb1		Appr/.Irre	Dn/B	61.75 ×52.00	Small/Irre	Dn/Ely	Bl
	Rb2		Appr/Irre	Dn/B	96.29 × 78.23	Md/R to O	Dn/Ely	Bl
	Rb3		Flocc/Irre	Dn/B	89.75 × 82.50	Small/Irre	Dn/Dly	Bl
	Rb4	25	Appr/Even	Sp/H	100.98 × 82.33	Md/R to O	Dn/Ely	Bl
	Rb5		Flocc/Irre	Dn/B	69.43 × 56.13	Small/Irre	Dn/Ely	DB
	Rb6		Appr/.Irre	Dn/B	92.08 × 83.95	Md/R to O	Dn/Ely	Bl
	Rb7		Flocc/Irre	Dn/LB to B	84.50 × 74.75	Small/R to O	Dn/Dly	Bl
	Rb1		Appr/.Irre	Dn/B	55.25 × 48.29	Small/Irre	Sp/Ely	Bl
	Rb2		Appr/Irre	Dn/LB to B	89.38 × 79,89	Small/R to O	Dn/Ely	Bl
	Rb3		Flocc/Irre	Dn/B	50.55 × 43.33	Small/R to O	Sp/Dly	B
	Rb4	75	Appr/.Even	Sp/H. to LB	85.89 × 70.80	Small/R to O	Dn/Ely	Bl
	Rb5		Flocc/Irre	Dn/B	54.65 × 47.27	Small/R to O	Sp/Ely	Bl
	Rb6		Appr/Irre	Dn/LB to B	80.08 × 74.28	Small/R to O	Dn/Ely	Bl
	Rb7		Flocc/Irre	Dn/LB to B	60.35 × 53.39	Small/Irre	Dn/Dly	Bl

(Continued)

1	2	3	4	5	6	7	8	9
Tv-3	Rb1		Appr/.Irre	Sp/H	100.75 × 88.96	Md/O to E	Dn/Ely	DB
	Rb2		Flocc/Irre	Dn/H. to LB	114.96 × 100.75	Md/R to O	Dn/Ely	Bl
	Rb3		Flocc/Irre	Dn/B	88.00 × 76.62	Md/R to O	Dn/Ely	Bl
	Rb4	25	Appr/.Irre	Sp/H	121.46 × 101.56	Large/R to O	Dn/Ely	Bl
	Rn5		Flocc/Irre	Dn/LB to B	99.93 × 82.87	Md/Irre	Dn/Ely	Bl
	Rb6		Appr/.Irre	Dn/L Bl	99.12 × 90.18	Md/R to O	Dn/Ely	Bl
	Rb7		Flocc/Irre	Dn/B	107.25 × 90.18	Md/R to O	Dn/Ely	Bl
	Rb1		Appr/Irre	Sp/H	117.81 × 105.62	Md/O to E	Dn/Ely	DB
	Rb2		Flocc/Irre	Dn/H. to LB	124.31 × 108.87	Large/R to O	Dn/Ely	Bl
	Rb3		Flocc/Irre	Dn/B	82.30 × 68.28	Small/R to O	Dn/Ely	Bl
	Rb4	75	Appr/.Irre	Sp/H	132.53 × 107.76	Large/R to O	Dn/Ely	Bl
	Rb5		Flocc/Irre	Dn/LB to B	105.63 × 97.19	Md/R to O	Dn/Ely	Bl
	Rb6		Appr/.Irre	Sp/L Bl	104.31 × 86.46	Md/Irr	Dn/Ely	Bl
	Rb7		Flocc/Irre	Dn/B	120.65 × 103.18	Large/R to O	Dn/Ely	Bl
Tv-4	Rb1		Appr/.Irre	Dn/B	86.67 × 77.63	Small/R to O	Dn/Ely	Bl
	Rb2		Flocc/Irre	Dn/LB to B	118.05 × 101.83	Md/R to O	Dn/Ely	Bl
	Rb3		Flocc/Irre	Dn/B	66.62 × 63.37	Small/R to O	Sp/Ely	Bl
	Rb4	25	Appr/.Even	Sp/H. to LB	82.50 × 76.25	Small/R to O	Dn/Ely	Bl
	Rb5		Flocc/Irre	Dn/B	67.32 × 63.83	Small/R to O	Dn/Ely	Bl
	Rb6		Appr/.Irre	Dn/LB to B	91.00 × 82.33	Md/R to O	Dn/Ely	Bl
	Rb7		Flocc/Irre	Dn/B	59.64 × 52.34	Small/Irre	Dn/Ely	Bl
	Rb1		Appr/.Irre	Sp/LB to B	80.60 × 72.34	Small/R to O	Dn/Ely	Bl
	Rb2		Flocc/Irre	Sp/H. to LB	85.34 × 79.43	Small/R to O	Dn/Ely	Bl
	Rb3		Flocc/Irre	Dn/B	52.00 × 43.87	Small/R to O	Sp/Ely	Bl
	Rb4	75	Appr/.Irre	Sp/H. to LB	80.82 × 76.11	Small/Irre	Dn/Ely	Bl
	Rb5		Flocc/Irre	Dn/B	67.39 × 62.24	Small/R to O	Dn/Ely	Bl
	Rb6		Appr/.Irre	Dn/LB to B	82.41 × 73.12	Small/R to O	Dn/Ely	Bl
	Rb7		Flocc/Irre	Dn/LB to B	52.81 × 46.71	Small/Irre	Dn/Ely	Bl
Tv-5	Rb1		Appr/.Irre	Sp/LB	97.50 ×83.57	Md/R to O	Sp/Ely	Bl
	Rb2		Flocc/Irre	Dn/B	(c)	—	Dn(c)/Ely	Bl
	Rb3		Flocc/Irre	Dn/LB	48.75 × 43.87	V. Small/R to O	Sp/Ely	DB
	Rb4	25	Appr/Even	Sp/H	100.75 × 88.83	Md/R to O	Dn/Ely	Bl
	Rb5		Flocc/Irre	Sp/H. to LB	84.50 × 76.37	Small/Irre	Sp/Ely	Bl
	Rb6		Appr/.Irre	Dn/LB to B	108.75 × 95.00	Md/R to O	Dn/Ely	Bl
	Rb7		Flocc/Even	Dn/LB	70.31 × 64.11	Small/Irre	Sp/Dly	Bl
	Rb1		Appr/.Irre	Sp/H. to LB	(c)	—	Dn(c)/Ely	Bl
	Rb2		Flocc/Wavy	Dn/B	(c)	—	Dn(c)/Ely	Bl
	Rb3		Flocc/Irre	Dn/B	46.88 ×43.22	V. Small/D	Sp/Ely	Bl
	Rb4	75	Appr/.Even	Sp/H	(c)	—	Dn(c)/Ely	Bl
	Rb5		Flocc/Irre	Sp/H. to LB	(c)	—	Dn(c)/Ely	Bl
	Rb6		Appr/.Irre	Dn/LB to B	(c)	—	Dn(c)/Ely	Bl
	Rb7		Flocc/Even	Dn/LB	—	—	—	—

Appr...–Appressed, Flocc.–Floccose, Irre–Irregular, Dn–Dense, Sp–Sparse, B–Brown, DB–Dark Brown, Bl–Black, LB–Light Brown, LBl–Light Black, Md–Medium, R–Round, O–Oval, E–Elongated, Ely–Early, Dly–Delayed, H–Hyaline, V–Very, (C)*–Coalescence present individual sclerotia has the identity, (c)—Several sclerotia coalesced : individual sclerotia lost the identity

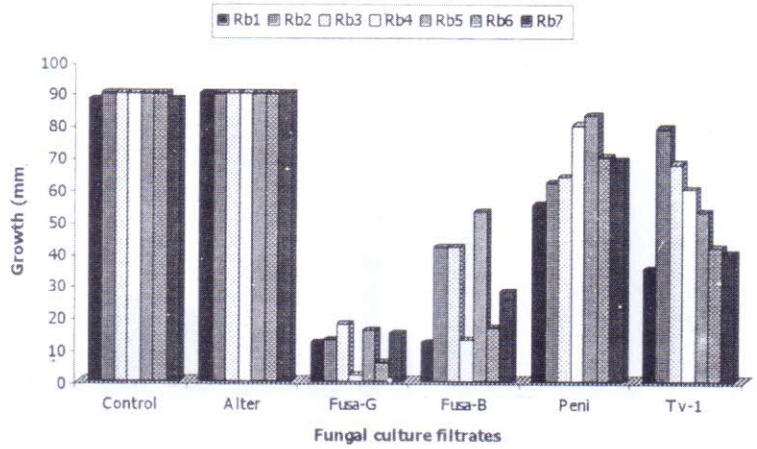


Fig.1. Effect of fungal culture filtrates (25%) on the growth of different isolates of *R. bataticola*

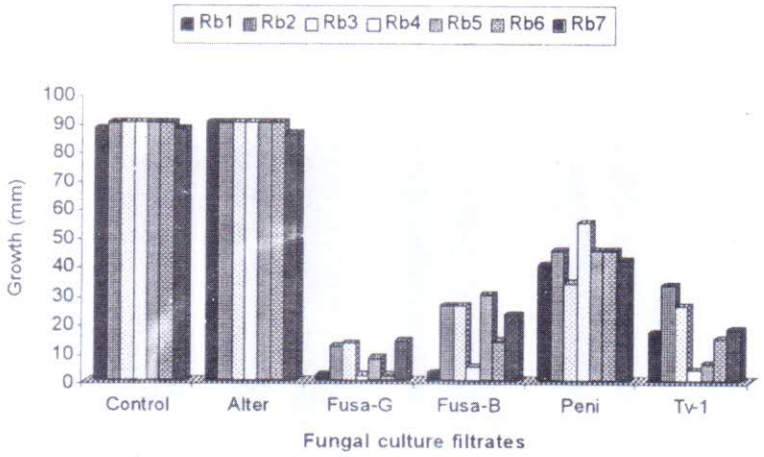


Fig.2. Effect of fungal culture filtrates (75%) on the growth of different isolates of *R. bataticola*

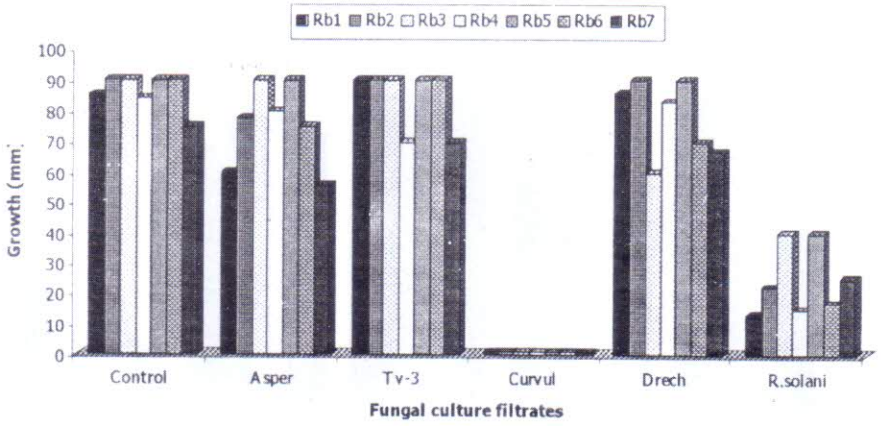
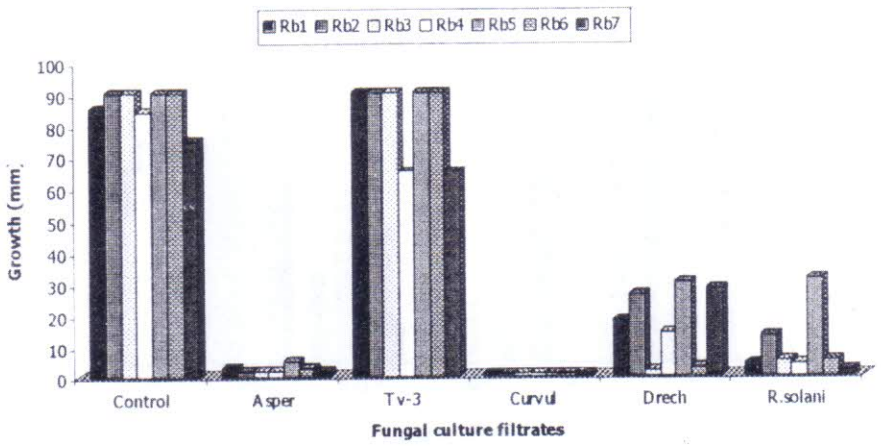


Fig. 3. Effect of fungal culture filtrates (25%) on the growth of different isolates of *R. bataticola*



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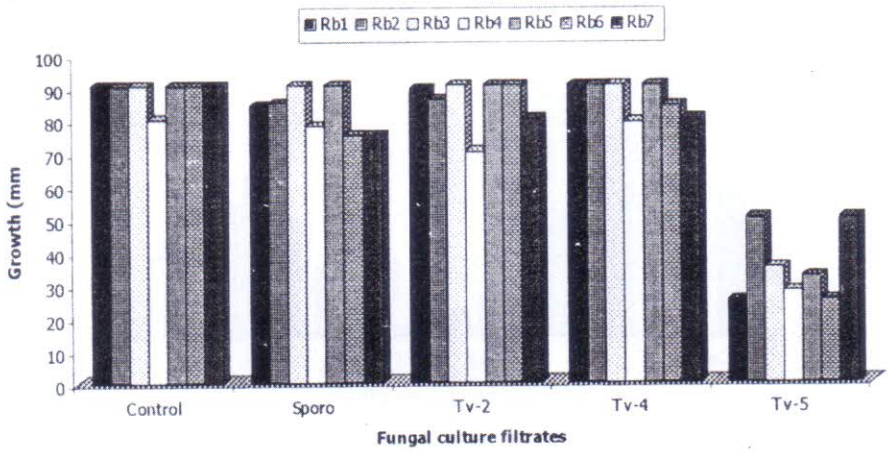

Fig.2. Effect of fungal culture filtrates (75%) on the growth of different isolates of *R. bataticola*

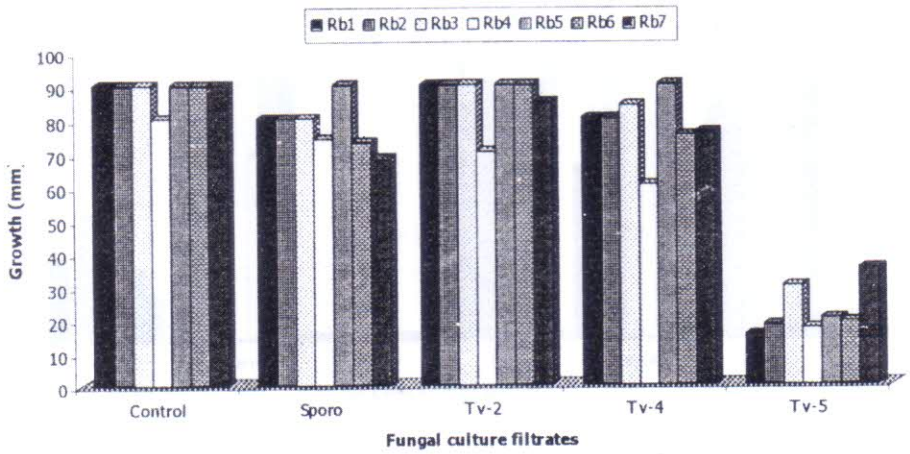

Fig. 3. Effect of fungal culture filtrates (25%) on the growth of different isolates of *R. bataticola*

The culture filtrates of fourteen fungi viz., *Alternaria alternata* (Fr.) Kriessler, *Curvularia pallescens* Coedijn, *Drechslera specifera* (Bainier) Boedijn, *Fusarium oxysporum* Schlecht from gram, *Fusarium oxysporum* Schlecht from barnyard millet, *Aspergillus nidulans* (Eidam) Winter, *Penicillium* sp., *Rhizoctonia solani* Kuhn, *Sporotrichum* sp. and five *Trichoderma viride* strains (Tv-1, Tv-2, Tv-3, Tv-4 and Tv-5) were tested *in vitro* against isolates of *R. bataticola*. The culture filtrates of *Alternaria alternata, Sporotrichum* sp., Tv-2, Tv-3 and Tv-4 were recorded to reduce minimum radial growth as compared to culture filtrates of *Aspergillus nidulans, Curvularia pallescens, Fusarium oxysporum* (gram), *Fusarium oxysporum* (Barnyard millet), *Penicillium* sp., *Drechslera specifera, Rhizoctonia solani,* Tv-1 and Tv-5.

Generally the growth inhibition and reduction in sclerotial size were found to increase with increase in concentration. Culture filtrate of *Curvularia pallescens* checked growth of isolates at both the concentrations.

Culture filtrate of *Fusarium oxysporum* (gram) was found more toxic than *F. oxyporum* (barnyard millet). Culture filtrates of *R. solani, Aspergillus nidulans, Drechslera specifera* totally inhibited growth of many isolates at higher concentrations and caused pronounced reduction in sclerotial size. Out of five strains of *Trichoderma viride,* strain Tv-1 and Tv-5 significantly inhibited the colony growth, sclerotia formation and reduced the size of sclerotia. Other strains Tv-2 and Tv-4 except Tv-3 also inhibited sclerotial size. Other morphological characters of isolates also observed to vary with different culture filtrates. Isolates showed differential sensitivity with culture filtrates.

REFERENCES

Cook, R. J. and Baker, K.F. 1983. *The nature and practice of biological control of plant pathogen.* American Phytopathological Society, St. Paul, USA.

Dubey, R. C. and Dwivedi, R.S. 1988. Antagonism between *Macrophomina phaseolina* and some rhizosphere microfungi of soybean. *Int. J. Tropical Plant Disease.*, **6**: 89-94.

Gajbe, D.W. and Lanjewar, R.D. 1991. Antagonism of *Aspergillus nigher* on some seed borne fungi of two rice cultivars. *PKV Res. J.*, **15**: 168-171.

Ghaffar, A 1968. Interaction of soil fungi with *M. Phaseoli* (Maubl.) Ashby, the cause of root rot of cotton. *Mycopath. Mycol. Appl.*, **34**: 196-201.

Ledeb, E.S., Novikova, N.D. and Kuznetsov, V.D. 1978. Production of penicilli and 6 amino penicillanic acid by some *Trichoderma* spp. (Abstr.) *Mikologia Fitopathologiya.*, **12**: 103-106.

Mukherjee, B. and Sen, C. 1992. *Aspergillus* and *Penicillium* species : potential agents for biocontrol of *Macrophomina phaseolina. Indian Phytopath.*, **45**: 39-43.

Pandey, A. 1985. Biocontrol characteristics of some moulds. *Biovigyanam.*, **11**: 14-18.

Phillips, A.J.L. 1986. Factors affecting the parasite activity of *Gliocladium virens* on sclerotia of *Sclerotina sclerotiorum* and a note on its host range. *Phytopath. Z.*,**116**: 212-220.

Pineda, P. JB. and Gonnella, E.ER. 1988. Evaluation and biological control of *Macrophomina phaseolina* in sesame *(Sesamum indicum* L.). *Agronomia Tropical Maracay.*, **38**: 43-48.

Rettinassababady, C., Ramadoss, N. and Thirumeni, S. 2000. Effect of culture filtrates of native isolates of *Trichoderma viride* on the growth of *Macrophomina phaseolina. Intern. J. Trop. Agric.*, **18**: 97-99.

Selvarajan, R. and Jeyarajan, R. 1996. Inhibition of chickpea root-rot pathogens, *Fusarium solani* and *Macrophomina phaseolina*, by antagonists. *Indian J. Mycol. Pl. Pathol.* **26**: 248-251.

Siddiqui, Z. A. and Hussain, S.I. 1991. Control of *Meloidogyne incognita* and *Macrophomina phaseolina* on chickpea by fungal filtrates. *Pakistan J. Nematol.*, **9**: 131-137.

Singh, R.D.N. and Kaiser, S.A.K.M. 1996. Biocontrol of charcoal rot pathogen *(Macrophomina Phaseolina)* of maize with *Fusarium solani* f.sp. *psidii. Adv. Plant Sci.*, **9**: 75-80.

Ushamalini, C., Rajappan, K. and Gangadharn, K. 1997. Inhibition of *Macrophomina phaseolina* and *Fusarium oxysporum* f.sp. *tracheiphilum* by antagonists under *in vitro* conditions. *Plant Dis. Res.* **12**: 168-170.

Velikanov, L.L., Cuhkonosenka, E.Y. Nikolaeva, S. and Zavelishko, 1994. Comparison of hyper-parasitic and antibiotic activity of the genus *Trichoderma pers.* Fr. and *Gliocladium virens* Miller, Giddens at Foster isolates towards the pathogen causing root rot of pea. *Mikologiya Fitopathologiya.*, **28**: 52-56.

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