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In Vitro Evaluation of Fungicides, Weedicides and Insecticides Against Antagonistic Fungi, *G. virens* and *T. Koningii*

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Abstract

Sensitivity of antagonistic fungi *T. koningii* and *G. virens* was evaluated against different agrochemicals viz. Fungicide, weedicides and insecticides which are commonly used for crop protection. Three tested fungicides viz. vitavax, vitavax-200 and thiram were not evaluated at concentrations of 1, 5, 10, 25, 75 and 100 µg a. i. /ml. Both the antagonists were sensitive to vitavax up to the 10 µg a. i. /ml., but sensitive to vitavax-200 and thiram. Six commonly used weedicides viz., lasso, basalin stomp, soproturan machete 2,4-D and four insecticides viz., carbofuran thimet, thiodan and deceis were evaluated at the concentrations of 1, 5 and 10 µg a.i./ml. All the insecticides exhibited no or little adverse effect on the radial growth of both the antagonists. Out of the six weedicides studied no one had any inhibitory effect on the radial growth of *T. koningii* and *G. virens* at 1 µg a.i./ml.

Key words : *Trichoderma, Gliocladium,* Bioassay, Fungicides, Insecticides.

It is well known that certain diseases can be controlled either completely or partially by the use of biocontrol agents. It is understood that best methods of disease control is through integrated disease management where a bio-control component would be significant (Upadhuyay and Rai (1988). Development of an integrated management approach, therefore can significantly amplify the economic effectiveness of biological control in certain areas (Nigam and Mukherjee 1980). Fungicides and biological control agents are by far the two most important components of an integrated disease management system (Kalssen 1982). Integrating biological control agents with sub-lethal dose of fungicides seems to be a promising way of controlling pathogens with minimal interference with the biological equlibrium (Chet 1987). However, for doing so the antagonist must be essentially insensitive to the fungicides and for other agrochemicals viz. weedicides and insecticides, used in crop production program. Species of *Trichoderma* and *Gliocladium* are insensitive to many commonly used fungicides (Mukhopadhyay et al. 1992) but are highly sensitive to benzimidazole and dicarboxymides. In the present investigation vsensitivity of antagonistic fungi. *T. koningii* and *G. virens* was evaluated against different commonly used agrochemicals. Insensitivity of *T. koningi*i and *G. virens* to different agrochemicals will make them highly suitable for exploitation of these antagonistic fungi in future within the framework of integrated disease management program.

Methods

Different agrochemicals were tested during the present investigation. Effect of these chemicals on radial growth of *G. virens* and *T. koningii* was studied by poisoned food technique on PDA (Nene and Thapliyal 1979). Stock solution (100 µg a. i./ml) of each chemical was prepared in sterilized distilled water. Stock solution was diluted with water and same amount of different diluted solutions were taken in 250 ml. Erlenmeyer flask containing 120 ml of sterilized melted PDA to obtain final concentration of 1, 5 and 10 µg a. i. /ml for calculation of the amount of different solutions to be added to the PDA the formula $C_1V_1 = C_2V_2$ was used, where C_1 and C_2 were concentrtion of the stock solution (µg/ml) and concentration (µg/ml) desired respectively and V_1 is the volume (ml) of the solution to be added to the measured volume (V_2) of PDA. PDA poisoned with different concentrations of various chemicals was poured into sterilized petriplates. After solidification, each plate was centrally inoculated with 6 mm disc of *G. virens* or *T. kningii* taken from the edge of 3 days old

Table 1. Effect of insecticides on radial growth of *G. virens* and *T.koningii* on PDA incubated at 28 ± 1C for 72h.Values are : average of three replications. Values in each vertical column followed by same letter do not differ significantly.

Insecticides	Concentration (µg/ml)	*G. virens* Radial growth* (mm)	*G. virens* Inhibition (%)	*T. koningii* Radial growth (mm)	*T. koningii* Inhibition (%)
Carbofuran	1	90.00 d	0.00	90.00 e	0.00
	5	90.00 d	0.00	90.00 e	0.00
	10	90.00 d	0.00	90.00 e	0.00
Thimet	1	90.00 d	0.00	90.00 e	0.00
	5	90.00 d	0.00	90.00 e	0.00
	10	90.00 d	0.00	90.00 e	0.00
Decis	1	90.00d	0.00	90.00 e	0.00
	5	83.00 c	7.70	75.66 c	15.93
	10	74.33 a	17.41	57.00 a	36.66
Thiodan	1	90.00 d	0.00	90.00 c	0.00
	5	90.00d	0.00	87.00 d	3.30
	10	78.00 b	13.33	71.00 b	21.11
Check	–	90.00 d	0.00	90.00 e	0.00
LSD at 5%		3.44	–	2.67	–

culture. Unamended PDA plates inoculated centrally with *G. virens* or *T. koningii* served as check. Three replications were maintained for each treatment. Plates were incubated at 28 + 1 C and colony diameter was measured when the check plates were fully covered with test fungus growth. Per cent inhibition (I) of growth was calculated by using the formula :

$$I = \frac{T\text{-}C \times 100}{C}$$

Where I = Inhibition (%),
C = Colony diameter
T = Colony diameter in amended medium (mm)

Results and Discussion

Bioassy of Insecticide

Four insecticides viz. carbofuran, thimet, decies and tiodan were evaluated at the concentration of 1, 5 and 10 µg a.i. /ml against the antagonist *G. Virens* and *T. koningii*. Carbofuran and thimet had no effect on *G. virens* and *T. koningii* up to concentration of 10 µg a. i. / ml (Table 1). Decies and thiodan did not inhibit the radial growth of *G. Virens* and *T.koningii* at concentration 1 µg a. i./ml.Thiodan slightly inhibited (3.3%) *T. koningii* but not *G. virens* at 5 µ g a. i./ml. At 5 µg a. i. /ml. At 5 µg a. i./ml concentration. Decies caused 7.7% inhibition of *G. virens* and 15.9% of *T. koningii*. Decies and thiodan at 10µg a.i./ ml were more inhibitory to the radial growth of *G. virens* and *T. koningii* (Table 1).

Bioassy of Weedicides

Six weedicides viz. isoproturan, machete, lasso, 2,4-d, basalin and stomp were tested at the concentrations of 1, 5 and 10 µg a.i./ml against *G. virens* and *T. koningii* (Table 2). At 1µg a.i./ml concentration both the antagonistic fungi *G. virens* and *T. koningii* were insenstive against all the tested weedicides. Maximum inhibition (8.5%) of the radial growth of *G.virens* was recorded against basalin at 10 µg a. i./ml while in *T. koningii* maximum sensitivity (3.5% inhibition) was recorded against lasso at 10 µg a. i./ml (Table 2).

Bioassay of Fungicides

The fungicides vitavax, vitavax 200 and thiram at the concentration of 2, 5, 10, 25, 75 and 100 µg a. i. /ml were evaluated the antagonists *G. virens* and *T. koningi*i . Vitavax had no adverse effect on radial growth of *G. virens* and *T. koningii* up to 10 µg a. i. / ml maximum inhibition of radial growth of *G. virens* (30.0%) and *T. koningii* (28.2%) was at 100 µ g a. i. / ml vitavax while in vitavax 200 ninimum inhibition of

Table 2. Effect of weediscides on radial growth of *G. virens and T. koningii* on PDA incubated at 28 ± 1C for 72 h. Values are average of three replications. Values in vertical columns followed by same letter do not differ significantly.

		G. virens		*T. koningii*	
Weedicides	Concentration (µ g/ml)	Radial growth* (mm)	Inhibition (%)	Radial growth* (mm)	inhibition (%)
Isoproturan	1	90.00 f	0.00	90.00 f	0.00
	5	90.00 f	0.00	89.00 f	1.10
	10	90.00 f	0.00	89.00 e	1.10
Machete	1	90.00 f	0.00	90.00 f	0.00
	5	88.83 e	1.85	90.00 f	0.00
	10	88.16 d	2.04	90.00 f	0.00
Lasso	1	90.00 f	0.00	88.16 bcd	2.04
	5	90.00 f	0.00	87.66 b	2.60
	10	87.66 c	2.00	86.83 a	3.52
2,4–D	1	90.00 f	0.00	90.00 f	0.00
	5	88.00 d	2.20	89.66 ef	0.37
	10	85.66 b	4.82	88.83 de	1.30
Basalin	1	90.00 f	0.00	90.00 f	0.00
	5	85.16 b	5.30	88.50 cd	1.60
	10	82.33 a	8.52	88.00 bc	2.20
Stomp	1	90.00 f	0.00	90.00 f	0.00
	5	88.66 e	1.48	90.00 f	0.00
	10	87.16 c	3.15	88.50 cd	1.60
Check	–	90.00 f	–	90.00f	–
LSD at 5%	–	0.5481	–	0.65	–

radial growth of *G. virens* (6.6%) and of *T. koningii* (5.9%) was recorded at 1 µg a. i. /ml, but maximum inhibition at the concentratiom of 100µg a. i. / ml was 81.5 and 83.0% respectively. Thiram was not inhibitory at 1µg a. i./ml but at 5 µg a. i./ml inhibited G. virens and *T. koningii* growth by 6.3%. At highest concetration of 100 µg. a. i./ml thiram inhibited the growth of *G. virens* by 78.9 and *T. koningii* by 74.8% (Table 3).

Insensitivity of *T. koningii* and *G.virens* to vitavax makes them highly suitable for exploitation within the framework of integrated disease manage-

Table 3. Effect of fungicides on radial growth of *G. virens* and *T. koningii* on PDA incubated at 28 ± 1C for 72 h. *Average of three replications. Values in each vertical column followed by same letter do not differ significantly.

		G. virens		*T. koningii*	
Fungicides	Concentration (µ g /ml)	Radial growth* (mm)	Inhibition (%)	Radial growth* (mm)	Inhibition (%)
Vitavax	1	90.00 n	0.00	90.00 n	0.00
	5	90.00 n	0.00	90.00 n	0.00
	10	90.00 n	0.00	90.00 n	0.00
	25	79.66 k	11.48	83.33 kl	7.04
	50	77.66 i	14.44	79.00 ij	12.22
	75	72.00 i	20.00	72.66 b	19.26
	100	63.00 g	30.00	64.66 f	28.15
Vitavax-200	1	84.00 m	6.60	84.661	5.93
	5	81.661	9.26	81.00jk	10.00
	10	79.33 k	11.85	77.33i	14.07
	25	67.00 h	25.55	69.00 g	23.33
	50	53.00 f	41.11	52.00 c	42.22
	75	47.00 e	47.77	49.00 d	45.55
	100	16.66 a	81.48	15.33 a	82.96

Table 3. Continued.

Fungicides	Concentration (µg /ml)	*G. virens* Radial growth* (mm)	*G. virens* Inhibition (%)	*T. koningii* Radial growth* (mm)	*T. koningii* Inhibition (%)
Thiram	1	90.00 n	0.00	90.00 m	0.00
	5	84.33 m	6.30	84.331	6.30
	10	79.00 k	12.22	82.00 k	8.80
	25	46.33 e	48.52	47.33 d	47.41
	50	33.00 d	63.33	32.00 c	64.44
	75	25.66 c	71.48	26.33 b	70.74
	100	19.00 b	78.88	23.33 b	74.80
Check		90.00 n	–	90.00 m	–
LSD at 5%		1.83	–	2.33	–

ment program. Pathogen weakened by the sub-lethal dose of a fungicide will certainly become vulnerable to the attack of the antagonist.

For getting healthy crop there is also a need of application of weedicides and insecticides in the field for the control of weeds and insects, respectively, Knowledge of effect of these chemicals on the antagonist would be helpful in the formulating successful integrated disease control program. None of the tested insecticides and weedicides showed any adverse effect on radial growth of bio control agent fungi *T. koningii* and *G. virens* at 1µg a.i./ml which is higher than field dose. Mukherjee et al. (1989) also found *T. koningii* and *G. virens* at 1µg a. i./ml which is higher than field dose. Mukherjee et al.(1989) also found *T. hargianum* insensitive tothimet and carbofuran at concentraton of 20 a. i./ml. Present findings suggest that since the commonly used agrochemicals had no adverse effect on *T. koningii* and *G. viren* at field dose, therefore these agrochemicals can sefely be used simultaneously with the antagonist.

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