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Geotrichum Candids Inciting Fruit Rot of Ivy Gourd in Synergistics Effect of Agrochemicals on Carbendazim

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Abstract: *There was variation in the MIC of carbendazim among the Geotrichumcandidus incitant of fruit rot of Ivy gourd (Cucurbitaceae) fruits and isolate on (CZA) CzapekDox agar medium plates. Minimum inhibitory concentration (MIC) on CZA plates ranged from 4000 µg/ml while it was more resistant with resistant factor 2. Use of carbendazim with–other agrochemicals like Fungicides (mancozeb, copper oxychloride, chlorothalonil), Insecticides (phorate, chlorpyriphos and endosulfan), Herbicides (metribuzin, sodium salt and atrazine), Antibiotics (bacipen, ambistryn–s and penicillin), Salts (mercuric, chloride, stannous chloride and barium chloride), and Fertilizers (MOP, urea, 10:26:26) inhibited the growth of the pathogen in invitro studies.*

Keywords: *Geotrichumcandidus,* agrochemicals etc..

I. Introduction

Ivy gourd (*Cocciniaindica* Wight and Arn.) of the family *Cucurbitaceae*. Is one of the important vegetables and medicinal fruits and plant, distributed in Tropical, Asia, Africa Pakistan, India and Sri Lanka (Cooke, 1903; Sastri: 1950). The Ivy gourd fruit is attacked by fungal pathogen. Among them fruit rot disease occurs in our country caused by *Geotrichumcandidus*. This disease is managed by applying various systemic and conventional fungicides. But in the present paper on attempt is made to manage the of fruit rot of Ivy gourd by using different agrochemicals.

II. Materials and Methods

Synergistic effects of various agrochemicals on the development of resistance infected pathogen were studied by mixing different fungicides, insecticides, herbicides, fertilizers, antibiotics and salts. Equal volume of chemicals were mixed in of alone carbendazim were studied (Bhale, 2002).

Effect of various agrochemicals on the development of resistance in *G. candidus* were studied by mixing different Fungicides (mancozeb, copper oxychloride, chlorothalonil), Insecticides (phorate, chlorpyriphos and endosulfan), Herbicides (metribuzin, sodium salt and atrazine), Antibiotics (bacipen, ambistryn-S and penicillin), Salts (mercuric chloride, stannous chloride and barium chloride) and Fertilizers (MOP, urea, 10:26:26). The equal volume of chemicals mixed @4000µg/ml alone carbendazim mixed with equal volume of agro-chemicals (25, 50, 75 and 100µg/ml and 0.1, 0.2, 0.3 and 0.4) were mixed in 4000µg/ml of carbendazim. The resistant and senstive isolates were selected for this study. It was grown on the CzapekDox agar medium (CZA) containing resistant dose of carbendazim4000µg/ml and other chemicals at above said concentrations. Increase in the growth of organisms over control was considered to be increase in the resistance while decrease was considered to be decrease in the resistance growth on carbendazim served as control.

Equal volume of chemicals were mixed in µg/ml of alone of carbendazimresistance isolates of pathogen was incubated on to the plates and its growth was observed at inhibited pathogens and percentage control efficacy (PCE) was calculated (Bhale et al., 2010).

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Percentage Control Efficacy (PCE) of Agrochemicals

The percentage control efficacy of each agrochemical was calculated as follows:

$$PCE = 100\left(1 - \frac{X}{Y}\right)$$

Where, X = is the diameter of the colony on fungicide treated agrochemical.
Y = is the diameter of the colony on the medium alone.

III. Results and Discussion

Agrochemicals such as fungicides, insecticides, herbicides, fertilizers, antibiotics and salts were mixed with carbendazim in the CzapekDox agar medium. Carbendazimresistant,Gc_6 isolates were inoculated onto the plates and its growth was observed after 8thday's incubation period. Increased growth over carbendazim alone control was considered as increase in the resistance and vice versa (Plate I).

- **Fungicides:** Results are depicted in tables 1. It is observed that Chlorothalonil 100 µg/ml with Carbendazim completely inhibited the growth of the resistant isolate of *G. candidus.* Copperoxychloride and Mancozeb also reduced the growth of *Geotrichumcandidus.*
- **Insecticides:** Among insecticides,Phorate, chlorpyriphos and endosulphan were mixed with carbendazim.Endosulphan at 75 µg/ml with Carbendazim at 4000 µg/ml was completely inhibited the growth of *G. candidus* (Table 2)
- **Herbicides:** Amongherbicides, indicated results in (Table 3).Metribuzin at 25 µg/ml with carbendazim at 4000 µg/ml was completely stopped the growth of the*Geotrichumcandidus.* Remaining salts also showed inhibition of the pathogens.
- **Antibiotics:** Among antibiotics, Bacipen, Ambistryn-S and Penicillin were mixed with carbendazim, (Table 4). Bacipen @-500 at 0.1 µg/ml with carbendazim at 4000 µg/ml was completely inhibited the growth *G. candidus.*
- **Salts:** Among salts, Mercuric chloride, Stannous chloride and Bariuchlorideat (0.1 to 0.4 µg/ml) were mixed with carbendazim. It is observed thatMercuric chloride at 0.4 µg/ml with carbendazim at 4000 µg/ml was completely stopped the growth of *G. candidus*(Table 5)
- **Fertilizers:** Among fertilizers, MOP, Urea and 10:26:26 were mixed with carbendazim. MOP at 0.3 µg/ml with carbendazim at 4000 µg/ml was completely inhibited the growth of *G. candidus*. (Table 6).

There are many reports findings to prevent further cases of resistance Ciba Geigy has adopted a basic strategy of the use of prepack mixture of metalaxyl with protective fungicides against foliar oomycetes (Staub and Sozzi, 1981). Benomyl with captan, chlorothalonil & imazilil reduced benomyl resistance in *Venturiainaequalis* (Shabi and Glipatric, 1981), *Sclerotiahomococarpic* & *Penicilliumdigitatium* (Eckert, 1981). Samoucha et al. (1987) reported synergistic interaction in the mixture of mancozeb plus symoxanil, mancozeb plus oxadinyl, cymoxanial plus oxydinyl in the control of *P. infestans*on tomato. Dekker (1981) suggested that there was significant delay of resistance build up in the pathogen when mixture of different fungicides was used.

There are theoretical models suggested by Kable & Jeffiry, 1980. Micronutrients when used in combination with carbendazim reduce the growth of resistant *Aspergillus flavus*ca using a flaroot disease of groundnut (Gangawane& Reddy, 1986). Griffin (1981) reported that fungicides and antibiotics having different mode of action are able to control resistant pathogen. Gangawane and Kamble (2001) found that when carbendazim was used in combination with agrochemicals inhibited the growth of resistant isolate of *Macrophominaphaseolina*causing charcoal rot of potato.

According to Patil (2009) carbendazim in combination with fungicides (Captan, Zineb, and Mancozeb), insecticides (methomyl, endosulphan and monocrophos) herbicides (2,4-D, Excel mera 71, and zepaclav 500), antibiotics (Griseofulvin and Oflaxacin 400), salt (potassium chloride and magnesium chloride), fertilizers (urea, muriate of potash, 10;26;26, mixture of urea, super phosphate, sufia, nimboli and potash), micronutrients (Mb, Co, Cu, Mn) completely inhibited the growth of *Macrophominaphaseolina* causing charcoal rot of sweet potato.Tilt in combination with fungicides (mancozeb, zineb, captan and rako), insecticides (Thimate and endosulphan), antibiotics (streptomycin and Griseofulvin) completely prevented the infection of *Phakopsorapachyrhizi* to soyabean plants.

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The growth of some organisms has been inhibited by herbicides which are meant to destroy weeds while some fungi have been affected by application of insecticides.(Chen et al., 2001; Das et al., 2003). Streptomycin mixed with oxytetracycline is used in control of fire blight of pome fruits and could delay the appearance of resistant strains (Vanneste, 2000) Application of carbendazim in combination with Thiram resulted in the highest seed germination percentage and lowest root rot incidence in chickpea (Prajapati et al., 2003). Synergistic effect of combining biocontrol agents with silicon against postharvest diseases of jujube fruit (Shiping,et al., 2005). Yeasts as biocontrol agents have been widely used to control postharvest diseases in various fruit because they do not produce antibiotics (Droby et al., 1998). The combination of biological control agents with selected chemicals produces a synergistic effect that enhances their efficacy for postharvest disease control (Droby, et al., 2003).

Sr. No.	Fungicides with Carbendazim (4000 µg/ml)	Linear growth (mm)	PCE
1)	Copper oxychloride		
	25	40.00	55.55
	50	36.00	60.00
	75	30.00	66.66
	100	25.00	72.22
2)	Chlorothalonil		
	25	17.00	81.11
	50	15.00	83.33
	75	11.00	87.77
	100	9.00*	90.00
3)	Mancozeb		
	25	20.00	77.77
	50	18.00	80.00
	75	17.00	81.11
	100	15.00	83.33
4)	Control (4000 µg/ml) Carbendazim alone	11.00	87.77
CD (P=0.05)		-	6.53

Table 1: Synergistic effects of fungicides on the development of Carbendazim resistance in *G. candidus* with latent period of 8 th days.

PCE= Percentage Control Efficacy. *Significantly reduced mycelial growth.

Table 2: Synergistic effects of insecticides on the development of carbendazim resistance in *G. candidus*with latent period of 8 th days.

Sr. No.	Insecticides with Carbendazim (4000 µg/ml)	Linear growth (mm)	PCE
1)	Phorate		
	25	00.00	100.00
	50	00.00	100.00
	75	00.00	100.00
	100	00.00	100.00
2)	Chlorpyriphos		
	25	17.00	81.11
	50	15.00	83.33
	75	14.00	84.44
	100	13.00	85.55

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3)	Endosulphan		
	25	16.00	82.22
	50	14.00	84.44
	75	12.00*	86.66
	100	00.00	100.00
4)	Control (4000 µg/ml) Carbendazim alone	11.00	87.77
CD (P=0.05)		-	4.87

PCE= Percentage Control Efficacy. *Significantly reduced mycelial growth.

Table 3: Synergistic effects of herbicides on the development of carbendazim resistance in *G. candidus*latentperiod of 8 th days.

Sr. No.	Herbicides with Carbendazim (4000 µg/ml)	Lineargrowth (mm)	PCE
1)	Metribuzin		
	25	11.00*	87.77
	50	00.00	100.00
	75	00.00	100.00
	100	00.00	100.00
2)	2, 4-D Sodium salt		
	25	17.00	81.11
	50	15.00	83.33
	75	00.00	100.00
	100	00.00	100.00
3)	Atrazine		
	25	00.00	100.00
	50	00.00	100.00
	75	00.00	100.00
	100	00.00	100.00
4)	Control (4000 µg/ml) Carbendazim alone	11.00	87.77
CD (P=0.05)		-	4.47

PCE= Percentage Control Efficacy. *Significantly reduced mycelial growth.

Table 4: Synergistic effects of antibiotics on the development of carbendazim resistance in *G. candidus*with latent period of 8 th days.

Sr. No.	Antibiotics with Carbendazim (4000 µg/ml)	Linear growth (mm)	PCE
1)	Bacipen @-500	10.00*	
	0.1	00.00	88.88
	0.2	00.00	100.00
	0.3	00.00	100.00
	0.4		100.00
2)	Ambistryn-S		
	0.1	00.00	100.00
	0.2	00.00	100.00
	0.3	00.00	100.00
	0.4	00.00	100.00
3)	Penicillin		
	0.1	00.00	100.00
	0.2	00.00	100.00
	0.3	00.00	100.00
	0.4	00.00	100.00

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4)	Control (4000 µg/ml) Carbendazim alone	11.00	87.77
CD (P=0.05)		-	2.65

PCE= Percentage Control Efficacy.*Significantly reduced mycelial growth.

Table 5: Synergistic effects of salts on the development of carbendazim resistance in *G. candidus*with latent period of 8 th days.

Sr. No.	Salts with Carbendazim (4000 µg/ml)	Linear growth (mm)	PCE
1)	Mercuric chloride		
	0.1	23.00	74.44
	0.2	20.00	77.77
	0.3	17.00	81.11
	0.4	15.00*	83.33
2)	Stannous chloride		
	0.1	33.00	63.33
	0.2	27.00	70.00
	0.3	24.00	73.33
	0.4	20.00	77.77
3)	Barium chloride		
	0.1	22.00	75.55
	0.2	20.00	77.77
	0.3	17.00	81.11
	0.4	16.00	82.22
4)	Control (4000 µg/ml) Carbendazim alone	11.00	87.77
CD (P=0.05)		-	3.80

PCE = Percentage Control Efficacy. *Significantly reduced mycelial growth.

Table 6: Synergistic effects of fertilizers on the development of carbendazim resistance in *G. candidus* with latent period of 8 th days.

Sr. No.	Fertilizers with Carbendazim (4000 µg/ml)	Linear growth (mm)	PCE
1)	MOP		
	0.1	16.00	82.22
	0.2	14.00	84.44
	0.3	13.00*	85.55
	0.4	00.00	100.00
2)	Urea		
	0.1	00.00	100.00
	0.2	00.00	100.00
	0.3	00.00	100.00
	0.4	00.00	100.00
3)	10:26:26		
	0.1	19.00	78.88
	0.2	16.00	82.22
	0.3	00.00	100.00
	0.4	00.00	100.00
4)	Control (4000 µg/ml) Carbendazim alone	11.00	87.77
CD (P=0.05)		-	5.31

PCE = Percentage Control Efficacy.
*Significantly reduced mycelial growth.

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