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Research Article

Synergistic Effect of Fungicides on Aureofungin Resistance in *Alternaria Tenuis* Causing Fruit Rot of Grape

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Abstract: Fruit rot of grape caused by *Alternaria tenuis* was found to be resistant to Aureofungin. Fungicides viz. Calaxin, Karathane, Blitox, Ziram and Benomyl individually and mixture with Aureofungin were tested both *in vitro* and *in vivo* against resistant mutant of *Alternaria tenuis*. Result indicated that individually Calaxin gave 100% control followed by Karathane, blitox, ziram and benomyl at 100 µg/ml. Use of Aureofungin mixed with fungicides, the PCE was again increased, calaxin gave 100% PCE.

Keywords: Fruit rot, Alternaria tenuis, Aurofungin.

INTRODUCTION

Grape (*Vitis vinifera* L.) is one of the very important fruit crop in India and abroad. However, fruit rot of Grapes is caused by many fungal pathogens. Among these, Fruit rot of grapes caused by *Alternaria tenuis* is destructive disease in the field as well as during storage and transport (Chahal and Malhi, 1969; Krishnaiah et al, 1983; Rao, 1994). Aureogungin is most effective fungicide against *Alternaria spp.* (Ghosh and Gemawat, 1976; Krishna et al, 1998). Fungicide resistant cases in various plant pathogens have been reported in India as well as in other countries (Wild, 1980; Annamalai and Lalithakumari, 1990; Gangawane et al, 1995). The main objective of present study was to find out the synergistic effect of fungicides on the management of Aureofungin resistant mutant of *Alternaria tenuis.*

MATERIAL AND METHODS

The sensitivity of *Alternaria tenuis* isolates to Aureofungin was determined by food poisoning technique (Nene and Thaplial, 1993). Czapek Dox agar plates containing different concentration (50 – 1000 µg/ml) of Aureofungin were prepared. Disc (4mm) of pathogen isolates taken from the margin of 7 days old colony were placed in the center of agar plates. These plates were then incubated at 26± 3°C and linear growth was measured at different intervals up to a week. MIC and ED_{50} were calculated. Thus the sensitivity of twenty isolates was determined. There was a large variation in the sensitivity of isolates. During present investigation, disease resistance of the pathogen was developed by chemical mutation and it was used for further study as suggested by Dekker (1982).Thus the EMS-At-3 mutant was obtained with highest resistant factor 6 and used for present study. The agar plates containing individually or in mixture of Aureofungin and fungicides (10, 50 and 100 µg/ml) were prepared and inoculated with resistant mutant. The agar plates without treated serve as control. The percentage control efficacy (PCE) was calculated 8 days after incubation period.

In vivo studies were carried out on fruit of grape. The fruits were surface sterilized by treating them with 1% $Hgcl_2$ solution and were washed ten times with sterilized distilled water. The fruits were then treated with the mixture of Aureofungin and fungicides (50 and 100 µg/ml). The resistant mutant *Alternaria tenuis* was inoculated by pin prick method on the fruits and they were incubated for a week at 26 ± 3°C in the laboratory. Fruits without treatment served as control. Percentage disease index (PDI) was determined and then on PDI, the percentage control efficacy was calculated by using following equation –

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PCE = 100 (1- x/y)
Where,
x = Diameter of colony in treated plates or Percentage disease index of treated fruits
y = Diameter of colony in control or Percentage disease index of untreated fruits.

Table 1. Percentage control efficacy (PCE) of Fungicides individually and in mixture with aureofungin against aureofungin resistant mutant (EMS-At-3) of *Alternaria tenuis* on agar plates.

Sr. No.	Fungicides (µg/ml)	Individual (PCE)	Mixture (PCE)
	Benomy 10	11.27	47.68
1	50	23.74	58.47
	100	38.37	72.16
	Blitox 10	15.81	58.67
2	50	32.55	70.34
	100	50.14	78.26
	Calixin 10	61.86	74.53
3	50	84.65	90.16
	100	100.00	100.00
	Karathane 10	47.64	64.46
4	50	56.27	77.93
	100	74.90	95.85
	Ziram 10	13.95	51.73
5	50	27.93	66.54
	100	45.34	75.81
6	Aureofungin (800 µg/ml)	44.67	-
	S. E.	6.19	3.78
	C.D. at 0.05	55.72	78.38
	0.01	59.92	80.94

Table 2. Percentage control efficacy (PCE) of Fungicides individually and in mixture withaureofungin against aureofungin resistant mutant (EMS-At-3) of *Alternaria tenuis*on grape fruits

Sr. No.	Fungicides (µg/ml)	Individual (PCE)	Mixture (PCE)
1	Benomy 50	18.67	48.82
	100	31.46	66.74
2	Blitox 50	24.27	60.21
	100	38.65	70.93
3	Calixin 50	66.72	86.74
	100	92.43	100.00
4	Karathane 50	39.24	69.92
	100	58.42	82.44
5	Ziram 50	18.24	57.24
	100	33.41	67.42
6	Aureofungin (800 µg/ml)	38.94	-
	S. E.	6.46	4.52
	C.D. at 0.05	52.46	78.47
	0.01	56.84	81.53

RESULTS AND DISCUSSION

Present study revealed that individually Calaxin gave 100% control followed by Karathane, blitox, ziram and benomyl at 100 µg/ml when tested *in vitro and in vivo*. But when Aureofungin was used in mixture with fungicides, the PCE was highly increased, calaxin gave 100% PCE followed by karathane, blitox, ziram and benomyl (Table 1). Similar results was obtained on fruits of grape (Table 2).

The results are in agreement with the finding of earlier workers, Shabi and Glipatric (1981) reported that used of benomyl with captan, chlorothalonil and imazil reduced benomyl resistance in *Venturia inaequalis.* Gangawane L.V. and Kamble S.S. (2001) found that when carbendazim was used in combination with agrochemicals inhibited the growth of resistant isolate of *Macrophomina pahseolina* causing charcoal rot of potato. Bhale et al (2009) showed that use of benomyl with captan inhibited the growth of *Fusarium oxysporum* causing wilt of spinach. Dekker, 1981; Gangawane and Readdy, 1987 suggested that there is significant delay of resistance build up in the pathogen when the mixture of different agrochemicals was used.

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