Integrated Management Of Zizyphus Fruit Rot Caused by Carbendazim Resistance Using Agrochemical like Antibiotics, Herbicide, Micronutrient Combination with Carbendazim.

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ABSTRACT: : *Various agrochemicals like fungicides, antibiotics, insecticides, herbicides and micronutrients were used individually and in combination with carbendazim. Most of these agrochemicals are also used in agronomic practices for the management of Zizyphus orchards. In vivo experiments were carried out as per the method suggested earlier. Certain Micronutrients when used singly or in mixture with Carbendazim reduce resistance in Aspergillus flavus. Integrated disease management of a disease have been emphasized nowadays. Hence, plant extracts alone and in combination with Carbendazim and other agrochemicals were used individually and in combination with Carbendazim for the management of Zizyphus fruit rot caused by resistant mutant of Aspergillus niger.*

Key Words: *Antibiotics, Herbicides,, Micronutrients, Fruit rot, Resistance, Agrochemical ,In vivo, Carbendazim,Aspergillus niger,Zyzyphus.*

Introduction

The Ber (*Zizyphus mauritiana* Lamk.) is an important fruit crop of arid and semi arid tropics in our country. It is xerophytic in nature and survives well under water stress conditions. The fruits are very nutritious and are available at low cost. Hence it is really a poor mans fruit. Nowadays it is also grown in the parts of central Asia, China and Taiwan. In India it is grown on marginal land in the hot and arid region of Rajasthan, Punjab, Haryana, Uttar Pradesh and Gujarat. In Maharashtra the *Zizyphus* plant is found in every field wherever irrigation facilities are less. The genus *Zizyphus* belongs to the family Rhaminaceae and consist of 40 species in tropical and subtropical regions. Of these *Zizyphus jujube* and *Zizyphus mauritiana* are more common in Maharashtra. There are more than 125 cultivars grown in India developed by selection in different regions. However the ber suffers from various diseases like powdery mildew, sooty mold, *Alternaria* leaf spot and *Phoma* leaf spot. The fruits are attacked by many pathogens at pre and post harvest condition and spoil the taste and market quality. Under WTO the fruits are supposed to be free from the diseases in order to export them aboard. Therefore it was considered to study the post harvest diseases of *Zizyphus* fruits in market and storage *conditions in Maharashtra and workout the management strategies.*

Among the post harvest pathogens *Aspergillus niger* was observed to be most common in Maharashtra state. There are reports that pre and post harvest diseases of various fruits can be managed through systemic and conventional fungicides including carbendazim The aim of the present study was therefore to examine the possibility of development of resistance in *Aspergillus niger* against carbendazim and to find out the different integrated methods to manage this pathogen causing fruit rot of *Zizyphus* . The samples of *Zizyphus* fruits infected with different pathogens were collected from the market at different places in Maharashtra., *Aspergillus niger* was found to be dominant on maximum fruits. Hence isolates of *Aspergillus niger* were isolated for the study. The sensitivity of isolates was tested against carbendazim and ED_{50} and MIC was confirmed. There appeared to be quite a large variation in the sensitivity of the isolates.

Review of Litreture

Various types of the fruit rot of Ber have been reported by Pawar and Vyas (1974) and Gupta and Madaan (1978), Manoharachary *et. al.,* (1989), Sharma *et. al.,* (1981), Srivastava (1967), Sumbali and Mehorotra (1982) and Ullasa and Rawal (1986), Vayas and Pawar (1974) and Wadia and Manoharachary (1980).

Fruit rot of *Zizyphus mauritiana* was found due to *Aureobasidium pullulans* was found in Ber var. Gola. The fruit rot showing black lesions and therefore these species was named black rot of Ber(Nallathambi *et. al.,* 2001).

Twenty one cultivars of *Zizyphus* were screened against blight caused by *Alternaria alternata* during 1981 and 1982. Seven fungicides such as Carbendazim, Triadimefan, Zineb, Copperoxichloride, DBP

and carboxin were evaluated *in vitro* and *in vivo*. Here carbendazim, zineb and carboxin were found effective in reducing diseases incidence.

Singh and Sumbali (2000) noted eighteen different fungal species on zuzubi fruits. Of these *Aspergillus flavus* infection was found to be significant. This post-harvest pathogen not only resulted in maximum loss of ascorbic acid on the fruit tissues but also induced aflatoxin production during the process of pathogenesis.

They also noted approximately 85.7% of the *Aspergillus flavus* isolates associated with zuzubi decay were toxigenic. Similarly, Singh and Sumbali (2000) also recorded various fungal species on the surface of zuzubi fruits.

Material and Method

Pathogenicity Test

Ber fruits were surface sterilised with 0.01% $HgCl_2$ solution and washed 10 times with sterile distilled water. They were inoculated with spore suspension of *Aspergillus niger* isolates or mutants sensitive or resistant to carbendazim. Percentage control efficacy (PCE) was calculated (Cohen, 1989). In order to study the effect of carbendazim or other fungicides. Fruit wrapping technique by using tissue papers was used. After 12 days fruits were carefully handled and infection on fruit was classified in the following grades (Singh and Bedi, 1984) and PDA was calculated.

Different agrochemicals were used for the integrated management of carbendazim resistance in *Aspergillus niger*. It was studied by mixing different Antiboitics (Aureofungin, griseofulvin, mycostatin and streptocycline), Herbicides (atrazine, gramoxone and 2,4-D); Micro-elements (Boron, copper, ferrous, magnesium, molybdenum) and 18 plant part extracts which have antifungal activity were mixed in carbendazim.

In vivo studies were carried out. This was done by using mycelial suspension of *Aspergillus niger* strain. AN EMS-9 was inoculated on ber fruits as described earlier for pathogenicity tests. Carbendazim and effective concentration of selected agrochemicals, extracts of medicinal plants were mixed well and ber fruits were treated with this solution. Percentage control efficacy (PCE) was recorded after 12 days.

Experimental result

a) Antibiotics

Aureofungin, griseofulvin, mycostatin and streptocycline were used in this study. Individually all these antibiotics were effective. Streptocycline and griseofulvin showed higher PCE at higher concentration. Along with carbendazim PCE of these antibiotics was increased. This increase was higher due to addition of carbendazim in streptomycin. This was followed by aureofungin, mycostatin and griseofulvin in decreasing order (Table 1 and Fig. 24).

b) Herbicides

Four herbicides were used in this study. Table 2 and Fig. 25a indicates that all the herbicides showed their percentage control efficacy when used individually, 2, 4-D gave higher PCE than that of weed off, gramoxone and atrazine. But along with carbendazim the PCE was again increased. This increase was higher in case of 2, 4-D followed by weedoff, gramoxone and atrazine in decreasing order. Higher concentration of these chemicals gave higher PCE.

c) Micro nutrients

Bo, Cu, Fe, Mg and Mo were used individually and in combination with carbendazim. Results in Table 3 and Fig. 25b indicate that all the micronutrients showed PCE on the *Zizyphus* fruits. Increase of the concentration again increased the PCE. Use of Mg alone gave higher PCE than other micronutrients, use of micronutrients in combination with carbendazim was found to more effective. Here Mo in combination with carbendazim was more effective than Cu, Mg, Fe and Bo.

Use of other agrochemicals

Various agrochemicals like fungicides, antibiotics, insecticides, herbicides and micronutrients were used individually and in combination with carbendazim. Most of these agrochemicals are also used in agronomic practices for the management of *Zizyphus* orchards. *In vivo* experiments were carried out as per the method suggested earlier.

Table 1: Percentage control efficacy (PCE) of carbendazim individually and in mixture with other antibiotics against resistant strain mutant (AN EMS-9) of *Aspergillus niger* on fruits of Ber

Sr. No.	Antibiotics (µg/ml)	PCE	
		Individual	In Mixture with Carbendazim
1	Aureofungin		
	50	62.8	70.0
	100	63.2	82.0
2	Griseofulvin		
	50	54.0	59.2
	100	70.4	78.1
3	Mycostatin		
	50	62.0	70.4
	100	66.8	75.2
4	Streptocyclin		
	50	51.2	72.0
	100	70.8	79.2
5	Carbendazim only (2.5 µg/ml)	52.8	--

Table 2: Percentage control efficacy (PCE) of carbendazim individually and in mixture with other herbicides against resistant strain mutant (AN EMS-9) of *Aspergillus niger* on fruits of Ber

Sr. No.	Herbicides (µg/ml)	PCE	
		Individual	In Mixture with Carbendazim
1	Atrazin	54	63.2
	50		
	100	62	66.4
2	Gramoxone		
	50	51.2	58.0
	100	62.8	70.0
3	Weedoff		
	50	59.2	66.8
	100	66.4	74.0
4	2, 4, D		
	50	58	70.8
	100	71.2	76.8
5	Carbendazim only (2.5 µg/ml)	50.0	--

Table 3: Percentage control efficacy (PCE) of carbendazim individually and in mixture with other microelements against resistant strain mutant (AN EMS-9) of *Aspergillus niger* on fruits of Ber

Sr. No.	Micronutrient (µg/ml)	PCE	
		Individual	In Mixture with Carbendazim
1	Bo 50	54.8	56.8
	100	62.4	70.0
2	Cu		
	50	46.0	51.2
	100	51.2	63.2

3	Fe			
		50	52.4	62.4
		100	63.2	74.0
4	Mg			
		50	62.0	66.0
		100	70.4	82.0
5	Mo			
		50	50.8	67.2
		100	66.0	71.2
6	Carbendazim only (2.5 µg/ml)		52.4	--

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