

GLOBAL JOURNAL OF BIO-SCIENCE AND BIOTECHNOLOGY

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EFFICACY OF ANTIBIOTICS AND BACTERICIDES ON THE MANAGEMENT OF "TIP-OVER" DISEASE OF BANANA

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ABSTRACT

Banana is one of the most important fruit crops cultivated in India. Bacterial disease caused by *Erwinia carotovora* subsp. *carotovora* on banana particularly in tissue cultured plantations occurred in severe form and causing severe losses in India. *In-vitro* evaluation of the various bactericides and antibiotics revealed that methoxy ethyl mercuric chloride @ 2000ppm, copper sulphate @ 4000ppm, streptocycline @ 750ppm and norfloxin @ 750ppm were found to be effective in inhibiting the growth of the pathogen. Two field trials conducted to evaluate the efficiency of various bactericides and antibiotics revealed that antibiotics either alone or in combination with copper sulphate or carbendazim were very effective in controlling the disease. Rhizosphere soil was drenched thrice with streptocycline either alone or in combination with copper sulphate or k-cycline plus copper sulphate completely suppressed the disease (100%) and increased the yield by 143.37% in one field trial. In another field trial, norfloxin plus copper sulphate gave very good control of disease (100%) followed by streptocycline plus copper sulphate. Methoxy ethyl mercuric chloride varied with respect to its efficiency in controlling the disease in the different locations, which is probably due to variations in soil type and soil temperatures.

KEY WORDS: 'Tip-over' disease, *Erwinia carotovora* subsp. *carotovora*, streptocycline, norfloxin, banana, bacterial rhizome rot

INTRODUCTION

Banana (*Musa* spp.) is one of the oldest cultivated tropical fruit crop in India next to Mango in both area and production. Banana is subjected to many serious diseases caused by fungi, viruses, bacteria and nematodes. The "Tip-over" or "bacterial rhizome rot" of banana was found to be severe in Karnataka state causing serious losses in all the major banana growing areas (Khan & Nagaraj, 1998). With the advent of tissue-culture techniques in the mass production of banana plantlets due to increase demand in view of the fast-expansion in the cultivation of banana, particularly around the cities, the "Tip-over" disease is assuming serious proportions and is fast spreading through the tissue culture plantlets to many new plantations and also old plantations, where fresh planting is done with high yielding varieties.

MATERIALS & METHODS

The bacterial pathogen Erwinia carotovora subsp. carotovora isolated from infected banana (cv. G-9) showing characteristic symptoms of tip-over disease and maintained in the Department of Plant Pathology, University of Agricultural Sciences, Bangalore, were used to test the sensitivity of the pathogen to the antibiotics and bactericides. The antibiotics and bactericide-s viz., streptocycline, streptomycin sulphate, k-cyclin. cephalaxin, norfiox, bactrim, methoxy ethyl mercuric chloride and copper sulphate at different concentrations (Table-1) were evaluated for their inhibitory effect. A heavy suspension of 48 hours old culture of Erwinia *carotovora*. subsp. *carotovora* $(7X10^{8} \text{ cfu/ml})$ was seeded with molten (50°C) nutrient agar contained in Erlenmeyer's flask, so as to get the thick growth of the bacterium. The seeded medium was poured onto the sterilized pertriplates and allowed to solidify. Sterilized filter paper discs (Whatman No. 44) measuring 8 mm diameters were soaked in different concentrations of the antibiotics/bactericide solutions for 10 min. Then the paper discs were placed on marked portion on the surface of seeded nutrient agar medium then the plates were incubated first at 5°C for 4 hours, so as to allow the diffusion of chemicals into the medium then at 30°C for 48 hours. Observations were recorded for the production of inhibition zone around the filter paper discs.

Two field trials carried out in the farmer's field with antibiotics/bactericides viz., streptocycline, norfloxin, kcycline, emisan-6 either alone or in combination with the fungicides/bactericides at the concentrations mentioned in Table-2 were evaluated for their efficacy in controlling the development of the disease. The experiment contained 10 treatments and three replications and in each replication five banana plants were maintained and laid out as per RCBD. The antibiotics/bactericides solution either alone or in combination were applied as soil drench around the affected plants by scraping surface soil and partially exposing the infected rhizome thrice at fortnightly interval. About 300 to 500 ml solution per plant was drenched depending on the plant growth, except bleaching powder, which was applied to the soil @ 18 kg/ha in the basin of the plant. Observations on various disease parameters were recorded a day before and a week after each drenching of chemicals.

Antibiotics/Bactericides	Concentration (ppm)	Mena inhibition zone (mm)
Streptocycline	300	32.16
	500	35.83
	750	37.00
Streptomycin sulphate	300	29.50
	500	32.00
	750	32.66
K-cycline	300	20.00
	500	31.83
	750	32.26
Norfloxin	300	32.34
	500	34.16
	750	34.83
Bacterim	300	26.34
	500	30.83
	750	32.83
Copper sulphate	3000	42.00
	4000	42.34
Methoxy ethyl mercuric chloride	1000	39.50
	2000	48.00
Som +	2000	40.00
$SCIII \pm CD at 10/$	-	2.09
CD at 1%	-	2.90

TABLE 1. In-vitro evaluation of antibiotics/bactericides on the growth of *Erwinia carotovira* sub sp. *carotovira* causing Tip-over of banana

RESULTS & DISCUSSION

The *in vitro* studies by using various antibiotics tested for their efficacy in inhibiting the growth of the bacterium, streptocycline produced largest inhibition zone (35.83 mm) followed by norfloxin (34.83 mm) and bactrim (32.83 mm) at 500ppm concentration respectively. Among the bactericides tested, methyl ethyl mercuric chloride was highly effective (48 mm) at 2000ppm. Whereas, copper sulphate produced an inhibition zone of 42 mm and 42.23 mm at 3000ppm and 4000ppm respectively (Table-1). Similar work by using Agrimycin at 1000 a.i., and streptocycline were found to be very effective in inhibiting the growth of bacteria (Stover, 1959; Mahmood *et al.*, 1981; Farag *et al.*, 1984; Parashar and Sindhan, 1988).

The field trials results revealed that complete control of the disease (100%) was recorded in the plots treated with streptocycline @ 500ppm alone, streptocycline plus copper sulphate, k-cycline plus copper sulphate and methoxy ethyl mercuric chloride (emisan-6) @1000ppm followed by the soil drench with k-cycline (500ppm), norflox (400ppm) either alone or in combination with copper sulphate (3000ppm) and k-cycline plus carbendazim (0.1%) in which the disease was suppressed to an extent of 90.90% (Table-2). Similar trend was observed in a second field trial conducted in Jalaki village of Bijapur district in Northern Karnataka except for methoxy ethyl mercuric chloride, where in only 40 per cent disease control was obtained (Table-4). Bleaching powder in both the field trials was found to be moderately effective in controlling the disease. Stover (1959), Mahmood et al. (1981), Farag et al. (1984) and Parashar and Sindhan (1988) where in they reported that though streptocycline completely checked the infection of Erwinia carotovora subsp. carotovora infecting banana and potato, however observed reduction in the germination of potato tubers compared to control. However, Chattopadhayay (1987), Lakshmanan and Mohan (1992) and Saini and Parashar (1981) reported that bleaching

powder drenched at 12.5 kg/ha was more effective in controlling the 'tip-over' disease as compared to other treatments. The variations observed in the performance of bleaching powder and methoxy ethyl mercuric chloride in two different agro climatic zones may be due to the differences in soil types, organic matter content of the soil and the soil temperature. Jalaki village of Bijapur district falls under the dry zones where soils are generally black clay soils and slightly alkaline in nature and soil temperature is fairly high as compared to sandy loam soils of Bangalore with moderate soil temperature and slightly acidic P^{H} .

The field trial conducted at Doddabelavangala, Bangalore rural district found that the treatments also have profound effect on the yield parameters such as hands/bunch, number of fingers/hand and bunch weight per plant. The yield recorded also varied significantly among the treatments. Maximum yield of 505 kg/15 plants was observed in streptocycline + copper sulphate treated plants, followed by norflox + copper sulphate (500.50 kg), K-clycline + copper sulphate (477.5 kg) as compared to control treatment (207.5 kg). However, K-cyline alone applied at 500ppm recorded a yield of 390.5 kg which was on par with methoxy ethyl mercuric chloride (357.5 kg). K-cycline + corbendazim (395 kg), streptocycline (370 kg) and norflox (367.5 kg) respectively. While, bleaching powder applied plants recorded a yield of 260.5 kg and the control plot gave 207.5 kg of total yield (Table-3). Parashar and Sindhan (1988) reported that streptocycline and methoxy ethyl mercuric chloride treated plants were effective in controlling the disease and increasing the yield. The yield parameters at Jalaki village of Bijapur district in Northern Karnataka region also showed similar results (Table 5), except Norflox plus copper sulphate recorded maximum total yield of 550 kg and it is on par with streptocycline + copper sulphate (500 kg) and Kclycline + copper sulphate (500 kg) compared to the control plots (230 kg).

SI.	Treatment	Concentration	Refore	Dicease	No.	of Plants infecto	d (%Disease in	icidence)	Dicease
No.		(ppm)	Before drench	Disease	Disease	Disease incidence	Disease incidence 3(Disease) incidence (0 Di
				after I drench	after II	after III	DA III	DA III	DA
					drench	drench	drench	drench	drenc
1	K-cycline	500	12(80.00)	11(73.34)	8(53.34)	6(40.00)	3(20.00)	2(13.34)	1(6.67
2	Sterptocycline	500	8(53.34)	8(53.34)	5(33.34)	3(20.00)	2(13.34)	1(6.67)	0(00.00
ω	Norflox	400	11(73.34)	10(66.67)	8(53.34)	4(26.67)	3(20.00)	1(6.67)	1(6.67)
4	Sterptocycline + CuSO4	500+3000	6(40.00)	6(40.00)	4(26.67)	4(26.67)	2(13.34)	1(6.67)	0(00.00)
S	K-cycline + CuSO4	500+3000	9(60.00)	9(60.00)	7(46.67)	3(20.00)	2(13.34)	0(00.00)	0(00.00)
6	Norflox + CuSO4	400+3000	12(80.00)	12(80.00)	9(60.00)	5(33.34)	3(20.00)	1(6.67)	1(6.67)
7	Bleaching Powder	8kg/acre	10(66.67)	9(60.00)	8(53.34)	5(33.34)	5(33.34)	3(20.00)	3(20.00)
8	K-cycline +Carbendazim	1 500+1000	10(66.67)	9(60.00)	7(46.67)	4(26.67)	1(6.67)	1(6.67)	1(6.67)
9	Emisan-6	1000	11(73.34)	11(73.34)	9(60.00)	3(20.00)	3(20.00)	2(13.34)	0(00.00)
10	Control		9(60.00)	9(60.00)	9(60.00)	10(66.67)	11(73.34)	11(73.34)	11(73.34
SEM :	IT		10.37	9.4	9.24	11.35	9.71	6.99	6.74
C.D.@	5%		30.82	27.93	27.46	33.73	28.83	20.77	20.2
	TARIE 3. Eff	fact of antibiotics (bact	* Figur	es in the parenthes	is is the percent ir	ncidence of the	disease	alahongla Rang	alore mral die
	Sl.No Trea	tments	D G	oncentration N	No. of Hands per	No. of fing	ers per Tota	al yeild (kgs)	%increase ove
	1 K-cy	/cline	5(8	3.33	25.00	390	s.	88.20
	2 Ster	ptocycline	50	00	.66	19.33	370	is.	78.55
	3 Nor	flox	40	00	5.66	18.33	367	is.	77.10
	4 Ster	ptocycline + Copper s	ulphate 50	0+3000 9	.33	28.00	505	.0	143.37
	5 K-cy	cline + Copper sulph	ate 50	0+3000 8	3.66	25.33	477	is.	130.12
	6 Nor	flox + Copper sulphate	40	0+3000 8	3.66	26.66	500	is.	141.20
	7 Blea	ching Powder	18	g/acre 8	.00	16.33	260	is.	25.54
	8 K-cy	cline +Carbendazim	50	0+1000 7	.33	22.00	395	.0	90.36
	9 Emi	san-6	10	6 00	0.00	24.00	357	j.	72.28
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Note: Average of 15 plants in 3 replications

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Grand Mean SEM± CD at (5%)

т. т. т. т.

0.58 1.72

1.83 5.45

і і і

7.96

22.1

323

					No. of Plants infec	ted (%Disease incider	ice)	
SI.	Treatments	Concentration	Total no. of	Disease incidence	Disease incidence	Disease incidence	Disease incidence	% reduction over
No.		(ppm)	plants	Before drench	after I drench	after II drench	after III drench	control
	K-cycline	500	15	11(73.34)	10(66.67)	7(46.67)	2(13.34)	86.66
2	Sterptocycline	500	15	12(80.00)	11(73.34)	7(46.67)	2(13.34)	86.66
ω	Norflox	400	15	12(80.00)	11(73.34)	5(33.34)	3(20.00)	80.00
4	Sterptocycline + Copper sulphate	500 + 3000	15	14(93.34)	9(60.00)	2(13.34)	1(6.67)	93.33
S	K-cycline + Copper sulphate	500 + 3000	15	13(86.67)	9(60.00)	2(13.34)	1(6.67)	93.33
6	Norflox + Copper sulphate	400 + 3000	15	12((80.00)	7(46.67)	1(6.67)	0(00.00)	100.00
Γ	Bleaching Powder	8kg/acre	15	13(86.76)	12(80.00)	11(73.34)	5(33.34)	66.66
8	K-cycline +Carbendazim	500+1000	15	14(93.34)	9(60.00)	6(40.00)	3(20.00)	80.00
9	Emisan-6	1000	15	14(93.34)	13(100.00)	12(80.00)	9(60.00)	40.00
10	Control		15	14(93.34)	15(100.00)	15(100.00)	15(100.00)	0.00
	SEM±		'	8.28	8.1	4.86	6.92	
	C.D.@ 5%		ı	24.61	24.07	14.46	20.56	ı

TABLE 4: Effect of antibiotics/bactericides on the incidence of tip over disease of banana caused by Erwinia carotovora subsp. carotovora at Jalaki, Bijapur district

SI.	Chemicals used	Concentration	Total number	No. of hands /	No of fingers/	Total yeild (kgs)	% yeild increase
No.		(ppm)	plants	bunch	hand		over Control
	K-cycline	500	15	9.33	25.66	442	93.00
2	Sterptocycline	500	15	9.00	25.33	450	95.65
ω	Norflox	400	15	8.66	23.33	445	93.50
4	Sterptocycline + CuSO4	500+3000	15	9.66	26.66	500	117.50
S	K-cycline + CuSO4	500+3000	15	10.00	27.33	500	117.50
6	Norflox + CuSO4	400+3000	15	10.66	28.66	550	140.00
7	Bleaching Powder	8kg/acre	15	7.33	19.33	325	41.50
×	K-cycline +Carbendazim	500+1000	15	9.33	24	477	94.34
9	Emisan-6	1000	15	7.00	15.33	305	32.00
10	Control	I	15	S	10.33	230	0.00
	SEM±			0.62	1.90		6.96
	CD at (5%)			1.94	496		20.77

Note: Average of 15 plants in 3 replications

ACKNOWLEDGEMENT

We kindly Acknowledge Late Dr. A.N.A. Khan, Retired Professor and Head, Department of Plant Pathology, University of Agricultural Sciences, Bangalore for his timely guidance for conducting this research work.

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