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Efficacy of different fungicides, oil paints, cow dung and *T. harzinum* against branch dying disease of mango

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Abstract
The laboratory experiment has been conducted for three years to study the efficacy of different fungicides, oil paints, cow dung and *T.harzinum* against branch dying disease of mango. The fungicides such as Bordeaux paste (10%), Carbendazim 20%, Copper Oxychloride 20%, Thiophanate methyl 20% and Cow dung slurry 80% when applied on infected portion after removing diseased bark could effectively control branch dying disease of mango.

Keywords: *T.harzinum*, Carbendazim 20%, Copper Oxychloride 20%, Thiophanate methyl 20%

Introduction
Mango (*Mangifera indica* L.) is an important fruit crop of the tropical and subtropical countries it is the important fruit crop grown on most of the regions in India. However the Mango crop is suffering from various diseases caused by diverse type of pathogens. The major disease such as Anthracnose, powdery mildew, blossom blight and soothy mould causes heavy damage to the mango crop. However there are some newly emerging disease such as branch dying widely spreading and causing heavy damage to the mango crop responsible for considerable yield losses of the crop. So the efforts has been made to study the efficacy of some locally available effective fungicides and another economical material such as oil paints and cow dung. The present study will help the farmers to select the effective control measure to control the branch dying disease of mango.

Materials and Methods
A field experiment was conducted for three years 2019-20 to 2021-22 at four lab, Regional Fruit Research Station Vengurle Dist. Sindhudurg. The local survey has been done and the plant samples infected with branch dying were collected. The pathogen has been isolated and the pathogencity has been proved. Then the field trial has been conducted on disease management. The infected branches were selected, tagged, scraped out infected bark and treated with respective treatments with various concentrations. The experiment was laid in Randomized Block Design (RBD) with three replications and eight treatments given in table no.1

Results and Discussion
The field experiments were conducted for three consecutive seasons and the pooled results are presented in Table 2. It was revealed from the table that all the seven treatments were found significantly superior over control at their tested concentrations and were statistically at par with each other. Application of Bordeux paste @ 10% and Black Japan were found most effective and given hundred per cent survival. Next in the rank were the treatments of Copper Oxychloride 50% WP paste @ 20% and Carbendazim 50 WP @ 20%, Thiophantae methyl 70% WP @ 20% and Cow dung slurry @ 80% with 83.33% survival. *Trichoderma harzianum* (Talc formulation) @ 10 g/lit was found less effective with 66.67% survival. However, all these treatments were statistically at par with each other. The economics of the trial was also worked out and given in Table 3. The cost of most of the effective treatments was lesser and varies between Rs.39/- to Rs. 68.00 for application of paste/ft^2 area however; the cost of treatments of Cow dung slurry @80% and Bordeaux paste @10% was very less than all other treatments The results of present investigation are in close conformity with the results obtained by Omprakash and A.K. Mishra who reported that the Bordeaux mixture and fungicide such as copper oxychloride can effectively control the mango disease such as Anthracnose.

The results are also in accordance with Stevens 1936 [5]; Sattar and Malik 1939 [4]; Chema *et al*. 1954 [1]; Tandon and Singh 1968 [6]; The cowdung is very effective in controlling branch dying disease it may be due to antimicrobial property of cowdung which restrict the growth of the pathogen. This has been supported by Rajeshwari (2016) [3] who reported that the antimicrobial activity of the cowdung can restrict the growth of the pathogen.

Table 1: The different treatment with different concentrations

Tr. No.	Treatment	Dose/ Conc. (%)
T_1	Bordeaux paste	10
T_2	Copper Oxychloride 50% WP paste	20
T_3	Thiophanate methyl 70% WP	20
T_4	Carbendazim 50%WP	20
T_5	*Trichoderma harzianum* (Talc formulation)	10 g/lit
T_6	Black Japan (Oil paint)	As it is
T_7	Cow dung slurry	80
T_8	Control (untreated)	-

Table 2: Efficacy of different treatment against branch dying disease of mango

Tr. No.	Fungicides	Conc. (%)	Per cent survival			Pooled Mean
			2019-20	2020-21	2021-22	
T_1	Bordeaux paste	10	100.00 (90)	100.00 (90)	100.00 (90.00)	100.00 (90)
T_2	Copper Oxychloride 50% WP paste	20	83.33 (65.91)	100.00 (90)	83.33 (65.91)	88.89 (73.93)
T_3	Thiophanate methyl 70% WP	20	83.33 (65.91)	83.33 (65.91)	83.33 (65.91)	83.33 (65.90)
T_4	Carbendazim 50%WP	20	100.00 (90)	100.00 (90)	83.33 (65.91)	94.44 (81.97)
T_5	*Trichoderma harzianum* (Talc formulation)	10 g/lit	66.67 (54.74)	83.33 (65.91)	66.67 (54.74)	72.22 (58.46)
T_6	Black Japan (Oil Paint)	As it is	50.00 (45)	83.33 (65.91)	100.00 (90.00)	77.78 (66.97)
T_7	Cow dung slurry	80	83.33 (65.90)	83.33 (65.91)	83.33 (65.91)	83.33 (65.9.)
T_8	Control (untreated)	-	16.67 (24.09)	16.67 (24.09)	0.00 (00.00)	11.11 (16.06)
S.E. ±			13.90	12.68	12.68	6.86
C.D.@ 5%			42.18	38.45	38.45	20.82

* Figures in parentheses indicated Arc sin transformation

Table 5: Economics of different treatments for management of mango branch dying disease

Tr. No	Fungicides	Conc. (%)	Qty. of paste required/ft^2 (ml)	Man days required @ 1 hrs/ft^2 (hrs)	Qty. of material required to paste/ft^2 area (gm/ml)	Cost of treatments/ft^2 (Rs.)	Labour cost/ft^2 (Rs.)	Total cost Rs./ft^2 (Rs.)
T_1	Bordeaux paste	10	100	1	10	04/-	38/-	42/-
T_2	Copper Oxychloride 50% WP paste	20	100	1	20	14/-	38/-	52/-
T_3	Thiophanate methyl 70% WP	20	100	1	20	30/-	38/-	68/-
T_4	Carbendazim 50%WP	20	100	1	20	30/-	38/-	68/-
T_5	*Trichoderma harzianum* (Talc formulation)	10 g/lit	100	1	01	0.25= 01/-	38/-	39/-
T_6	Black Japan	Direct	100	1	100	17/-	38/-	55/-
T_7	Cow dung slurry	80	100	1	80	0.80= 1/-	38/-	39/-
T_8	Control (untreated)	-	-	-	-	-	-	

Cost of fungicides/ Material: Rs/Kg or Lit

1. Bordeaux paste = 400/-
2. Copper Oxychloride 50% WP = 700/-
3. Thiophanate methyl 70% WP = 1500/-
4. Carbendazim 50%WP = 1500/-
5. Trichoderma harzianum (Talc formulation) =250/-
6. Black Japan =175/-
7. Cow dung = 10/-
8. Cost of labour / day =300/-
9. Copper sulphate = 370/-
10. Lime = 30/-
11. Cost of labour / 1 hr =38/- Cost of labour / day

Conclusion

It is thus concluded that the Bordeaux paste (10%), Carbendazim 20%, Copper Oxychloride 20%, Thiophanate methyl 20% and Cow dung slurry 80% when applied on infected portion after removing diseased bark could effectively control branch dying disease of mango.

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