

Evaluation of Some Fungicides for Control of Smoky Blight Canker in Apple (*Malus x domestica*)

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ABSTRACT: Fungicides viz. Propineb 700 g/Kg, Mancozeb 88.23 w/w, Copper oxychloride, Tebuconazole 50% + Trifloxystrobin 25% , Carbendazim, Propiconazole, Tebuconazole 430 g/L, Fosetyl 800g/Kg completely inhibited mycelial growth of the smoky blight pathogen (*Sphaeropsis malorum*) of apple. Fungicides viz. Chlorothalonil, Myclobutanil 10% WP, Azoxystrobin, Hexaconazole, Difenconazole, Captan 70% + Hexaconazole 5% WP, Carboxin 37.5% + Thiram 37.5% , Flusilazole also restricted mycelial growth but to the tune of 60 – 90% without any significant difference. All these fungicides may now be subjected to field evaluation for the purpose of searching effective fungicidal chemical for control of smoky blight canker of apple.

Key words: Apple, Smoky blight canker, Fungicidal control.

INTRODUCTION

Apple (*Malus x domestica* Borkh) belongs to family Rosaceae is an important commercial temperate fruit crop of India. Himachal Pradesh being apple state of India produced 738.72 thousand tonnes of apple in the year 2013 - 14 (Anonymous, 2014). But, yield of apple per unit area in this state is low (6.5 t/ha) compared to other regions of the world (45 t/ha). Outbreak of several diseases from time to time alongwith other reasons such as poor quality planting material, inadequate technology, improper inputs etc. have been the major constraints in achieving the attainable yield. Many diseases caused by fungi, bacteria, viruses etc. are responsible for immediate and long term losses. Equally important have been outbreak of cankers in 1970s in the state (Agarwala and Gupta, 1971). Cankers are characterized as localized lesions on a branch or stem which result into sloughing away of plant tissues and creation of wounds increasing in size from season to season. As many as thirteen different cankers have been reported from Himachal Pradesh (Sharma and Sharma, 2012). Among different canker diseases of apple, three cankers viz, smoky blight (*Sphaeropsis malorum*), pink canker (*Corticium salmonicolor*) and *Cryptosporiopsis* canker (*C. corticola*) with 18, 22 and 16 per cent severity respectively, are most prevalent in apple orchards of district Kullu in Himachal Pradesh, India (Sharma, 2006; Sharma and Ram, 2008 and Sharma and Ram,

2010). Recently, several fungicides have been evaluated and effective spray as well as paint/paste schedules devised for effective management of canker complex. In a bid to devise better control strategy, presently, we also attempted evaluation of seventeen novel fungicidal formulations for control of smoky blight canker under *in vitro*.

MATERIALS AND METHODS

Formulations and concentrations of different fungicides used are given below:

Sr. No	Name of fungicide	Active ingredient	Dose Per 100 ml
1	Antracol	Propineb 700 g/Kg	300 mg
2	Dithane M45	Mancozeb 88.23 w/w	300 mg
3	Kavach	Chlorothalonil	200 mg
4	Blitox	Copper oxychloride	250 mg
5	Nativo	Tebuconazole 50% + Trifloxystrobin 25% w/w	40 mg
6	Boon	Myclobutanil 10% WP	400 mg
7	Amistar	Azoxystrobin	100 µl
8	Contaf	Hexaconazole	100 µl
9	Score	Difenconazole	100 µl
10	Bavistin	Carbendazim	100 mg
11	Taqat	Captan 70% + Hexaconazole 5% WP	200 mg
12	Tilt	Propiconazole	100 µl
13	Ergon	kresoxim-methyl 44.3% W/W	100 µl
14	Trooper	Carboxin 37.5% + Thiram 37.5%	100 µl
15	Folicur	Tebuconazole 430 g/L	150µl
16	Nustar	Flusilazole	60 µl
17	Aliette	Fosetyl 800g/Kg	300 mg

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Petri plate bioassay was employed for evaluating the mycelia growth inhibition capabilities of fungicidal formulations. Mycelial discs (8mm diameter) of 4-day-old test fungus (*Botryosphaeria* : *Botryosphaeria ribis*, *B. obtuse* (Schwein.) Shoemaker Ana: *Sphaeropsis malorum* Berk.) were aseptically transferred to the centre of the Petri plate containing PDA amended with concentrations of the fungicides given above. The fungicide - amended plates were incubated for four days at 20° C. Medium devoid of fungicide served as control. Fifteen replicates were maintained for each treatment. After incubation period the radial mycelial growth was measured. Percent inhibition of growth was calculated and values were subjected to the analysis of standard deviation about mean.

RESULTS

As shown in Fig. 1, as many as 8 fungicides viz. Propineb 700 g/Kg, Mancozeb 88.23 w/w, Copper oxychloride, Tebuconazole 50% + Trifloxystrobin 25% , Carbendazim, Propiconazole, Tebuconazole 430 g/L and Fosetyl 800g/Kg completely inhibited mycelial growth of the pathogen. Other eight fungicides viz. Chlorothalonil, Myclobutanil 10% WP, Azoxystrobin, Hexaconazole, Difenconazole, Captan 70% + Hexaconazole 5% WP, Carboxin 37.5% + Thiram 37.5% , Flusilazole restricted mycelia growth in the

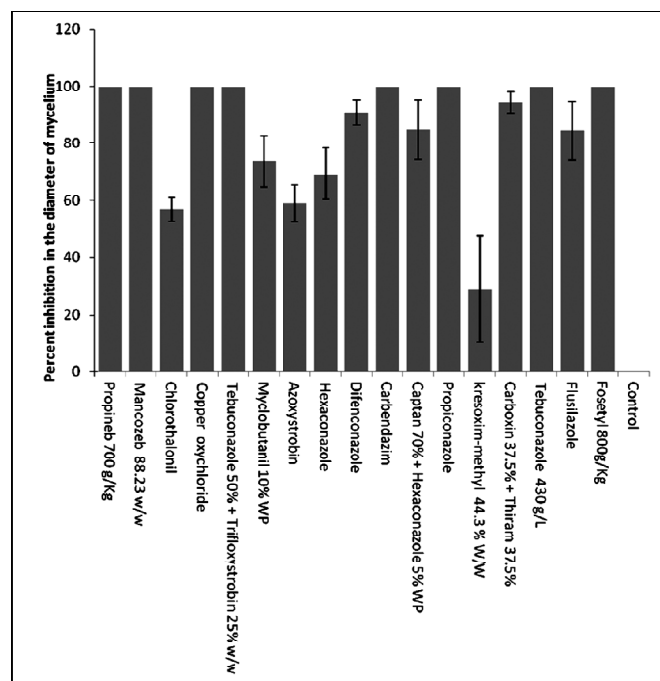


Figure 1: Mycelial inhibition of smoky blight pathogen recorded in Petri plate bioassay with different fungicides

range of 60 – 90% without any significant difference. Out of seventeen fungicides eight fungicides giving complete (100%) inhibition and significantly differed from other eight fungicides inhibiting mycelial. Fungicide kresoxim-methyl 44.3% W/W showed the poorest potential of inhibiting mycelial growth of pathogen upto 30% only which differed significantly from all other fungicides.

DISCUSSION

In the present study, fungicides could be categorized into three types for their potential to inhibit mycelial growth of smoky blight pathogen. First type inhibited mycelia growth completely (100%), second type induced inhibition in the range of 60 – 90% while third type represented by a single fungicide kresoxim-methyl 44.3% W/W restricted fungal growth very poorly to the extent of 30% only.

Among the first type of fungicides, the two candidates Carbendazim and Mancozeb while applied as spray in combination @ 0.25% at walnut stage, were found highly effective in canker management by Sharma and Ram (2010). But how they will perform singly while applied as spray for control of smoky blight canker is a matter of further investigation. Efficacy of Carbendazim and Mancozeb in inhibiting mycelial growth of another pathogen causing pink canker (*Corticium salmonicolor*) has also been reported by Prasada *et al.*, (2013). Fungicides of second type viz. difenaconazole, hexaconazole, flusilazol, and captan + hexaconazole also exhibited complete inhibition of mycelial growth of *C. salmonicolor* (pink canker) at all concentrations *in vitro* as reported by Prasada *et al.*, (2013), hence may prove to be effective in the management of canker complex of smoky blight and pink canker. All the effective fungicides reported above will now be subjected to field evaluation under *in vivo*. Presently, smoky blight pathogen was taken for pilot investigations and these studies will also be continued with other fungal pathogens inciting canker diseases on various pome and stone fruits in Himachal Pradesh.

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