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Raja
Department of Plant Pathology, Agriculture College, Bheemarayanagudi, UAS, Raichur, Karnataka, India

Gururaj Sunkad
Department of Plant Pathology, Agriculture College, UAS, Raichur, Karnataka, India

Amaresh YS
Department of Plant Pathology, Agriculture College, UAS, Raichur, Karnataka, India

Corresponding Author:
Raja
Department of Plant Pathology, Agriculture College, Bheemarayanagudi, UAS, Raichur, Karnataka, India

In vitro evaluation of contact fungicides against *Ceratocystis fimbriata* causing wilt in pomegranate

Raja, Gururaj Sunkad and Amaresh YS

Abstract
Pomegranate (*Punica granatum* L.) is an old fruit crop, having a place with the littlest herbal family punicaceae and pomegranate is a local of Iran. It is financially a significant organic product harvest of both tropical and subtropical locales. In India, it is viewed as an "essential money crop", filled in a space of 1, 16,000 ha with a creation of 89,000 MT with a typical efficiency of 7.3 MT. Karnataka State has the dissemination of developing pomegranate under tropical conditions in a space of 12,042 ha with a creation of 1, 29, 547 tons. It is affected by several diseases of which wilt one of the most important diseases caused by *Ceratocystis fimbriata.* Adequacy of eight contact fungicides was tried against *C. fimbriata* (Cf-26) by poisoned food strategy. Among contact fungicides captan, mancozeb, ziram, thiram, and zineb recorded the most extreme hindrance of (100 percent) mycelial development at all concentrations (0.10%, 0.20%, and 0.30%).

Keywords: Contact fungicides**,** concentrations, *Ceratocystis fimbriata*, percent

Introduction
Pomegranate (*Punica granatum* L.) is a historic fruit that originates from Iran and is a member of the punicaceae, the smallest botanical family. It is a crucial fruit crop for both tropical and subtropical climates commercially. It is grown in 1,16,000 ha area in India and is said to as a "vital cash crop", since it produces 89,000 MT with an average yield of 7.3 MT. In the Karnataka area distribution of 12,042 ha and a yield of 1,29,547 tonnes of production (http://nhb.gov.in), the state of Karnataka is home to pomegranate cultivation. Bijapur, Bellary, Bagalkot, Koppal, Chitradurga, Belgaum, Davangere, Tumkur, Bangalore, and Gulbarga are among the areas where this crop has spread. Among the ten commercially significant diseases that affect pomegranates, bacterial blight or spot, fruit rot, anthracnose, and wilt complex are severe and have recently resulted in large losses. The most serious disease in Karnataka is wilt caused by *Ceratocystis fimbriata*, which kills pomegranate plants and causes yellowing, drooping, and death, costing farmers money. It is important to gather data on the effectiveness of novel and existing fungicides *in vitro* to control wilt within the acceptable range of fungicidal residues allowed by the importing nations.

Materials and Methods
Isolation of the pathogen: The wilt-related *Ceratocystis fimbriata* was found infected in the pomegranate plant stems and roots that were taken from the Ganjalli field and isolated the same. The sliced portions of the collected stem segments that displayed the vascular staining symptoms were surface sterilized with 1% sodium hypochlorite (NaHCO3) for about 2 minutes before being cleaned twice in sterile water and once in 70% alcohol to get rid of any remaining $NaHCO_3$ traces. The carrot bait approach (Moller and DeVay,) [3] was used to isolate the pathogen. In this method, stems were inserted between carrot disks, stored in a humid chamber, and cultured at 25 °C with a 12-hour photoperiod. A part of the fungus was moved to freshly made PDA and oat meal agar media after perithecium formation so that they may mature fully. Under a high-power (40x) microscope, the ascospores, aleroconidia, endoconidia, and perithecia from Raichur isolates in the pure culture were examined to establish the fungus' identity. According to Sharma *et al.* [4], pathogen studies have been identified.

***In-vitro* evaluation of fungicides:** *In vitro* evaluation of commonly available fungicide molecules was carried out in a separate set of experiments with a completely randomized design using the poisoned food method against *Ceratocystis fimbriata*. In the procedure for

poisoned food, 20 ml of oat meal agar medium was first combined with fungicides and poured into petri dishes with a 90 mm diameter, while the control treatment was kept going without the addition of fungicides. Five-millimeter C. fimbriata discs were positioned in the center of the plate after solidification. Plates were incubated at 26 ± 2 °C and each experiment was repeated four times. In the control treatment, measurements of colony diameter were collected once the test fungal growth had reached the petriplate's edge. Later, the formula was used to compute the percent inhibition of growth (Vincent) [8].

$$I = \frac{C - T}{C} \times 100$$

Where,
I = Percent inhibition,
C = Radial growth of fungus in control
T = Radial growth of fungus in treatment.

Results and Discussion

Using the approach of poisoned food, the effectiveness of eight contact fungicides was evaluated against *C. fimbriata* (Cf-26). The highest inhibition of (100%) mycelial growth was seen for the contact fungicides captan, mancozeb, ziram, thiram, and zineb at all concentrations (0.10%, 0.20%, and 0.30%). Copper oxychloride (48.52%) and chlorothalonil (386.32%) both showed moderate inhibition of 38.63%. Copper hydroxide at 0.10%, 0.20%, and 0.30%, respectively, showed the least inhibition of 8.34, 33.44, and 65.18 percent (Table 1 and Plate 1).

Fungicides are evaluated *in vitro* to get a general idea of how effective they are against pathogens in the least amount of time. This information can then be used as a guide for field testing. The highest inhibition of mycelial growth (100%) (Fig. 1) was seen in the current investigation among the eight contact fungicides captan, mancozeb, ziram, thiram, and zineb at all tested concentrations (0.10%, 0.20%, and 0.30%). Numerous researchers Vijaya *et al.* [7], Somasekhara [5], Khosla [2], Sonyal *et al.* [6], and Chaudhari *et al*., [1] reported similar outcomes.

Table 1: *In vitro* evaluation of different contact fungicides against *C. fimbriata*

Sl. No.	Fungicide	Percent inhibition at different concentrations (%)			
		0.10	0.20	0.30	Mean
1	Captan	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100 (90.00) *
2	Mancozeb	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100 (90.00)
3	Ziram	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100 (90.00)
4	Copper oxy chloride	16.48 (23.95)	26.15 (30.76)	73.28 (58.87)	38.63 (38.43)
5	Chlorothalonil	25.68 (30.45)	46.22 (42.83)	73.66 (59.12)	48.52 (44.15)
6	Thiram	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100 (90.00)
7	Zineb	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)
8	Copper hydroxide	8.34 (16.79)	33.44 (35.33)	65.18 (53.84)	35.65 (36.66)
	Mean	61.16 (51.45)	67.31 (55.13)	79.12 (62.81)	69.20 (56.29)

	S.Em.±	CD at 1 %
Fungicides (F)	0.09	0.34
Concentration (C)	0.05	0.19
F x C	0.15	0.58

* Figures in parenthesis arc sine transformed value

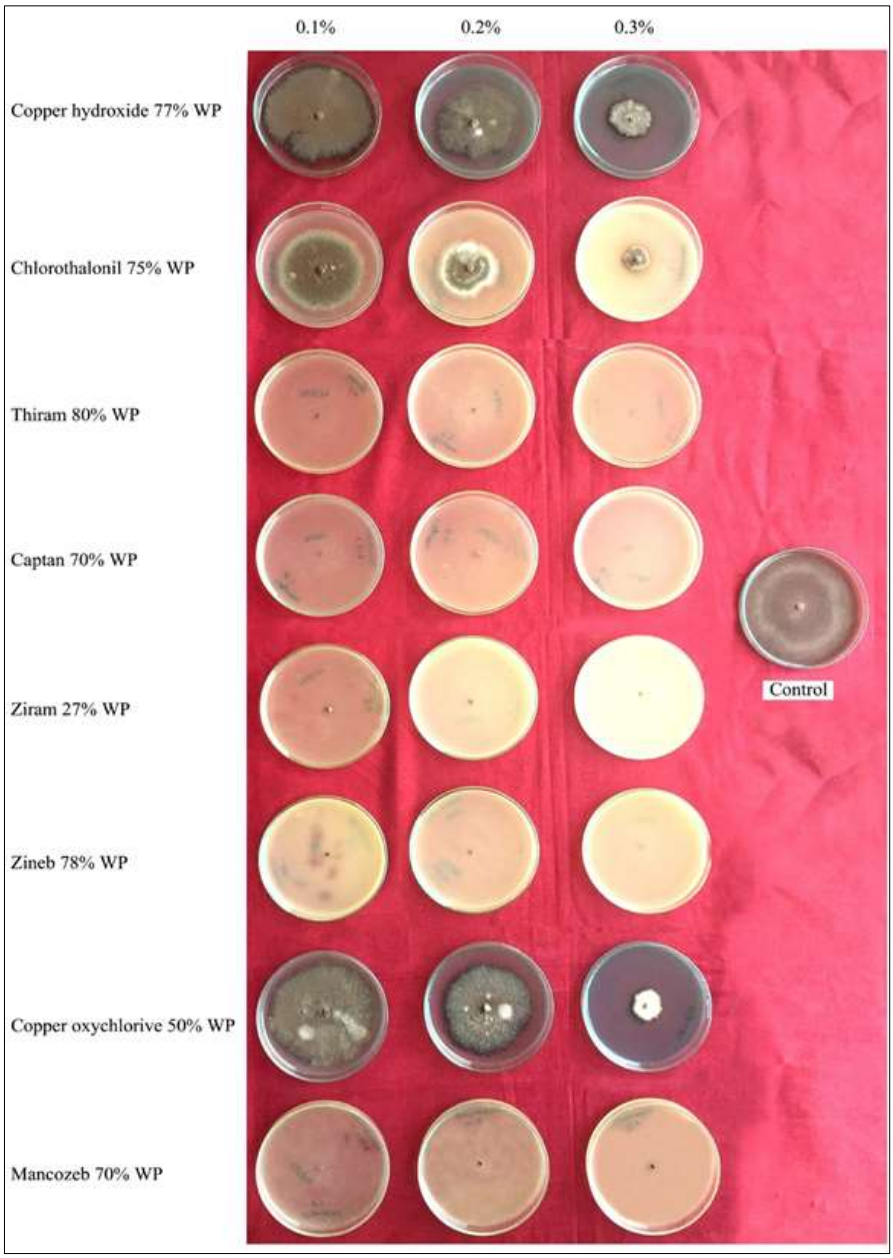

Plate 1: *In vitro* evaluation of different contact fungicides against *C. fimbriata*

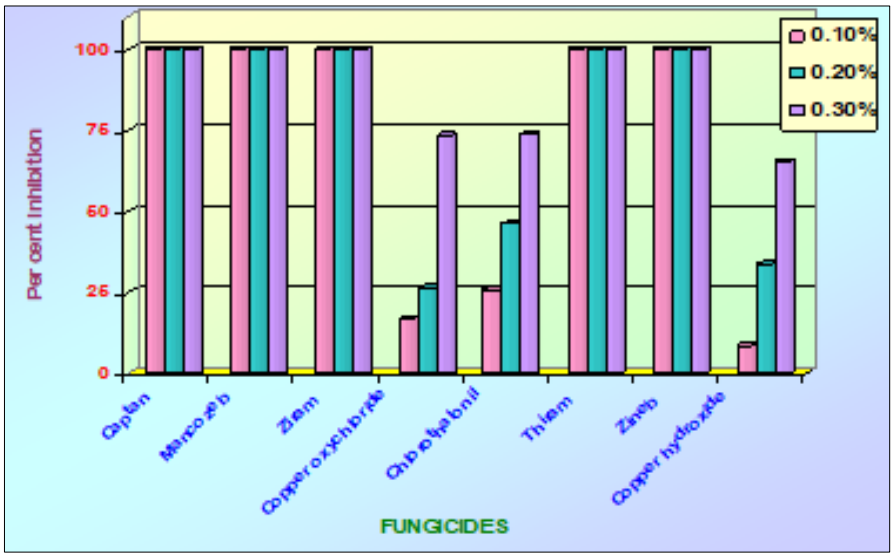

Fig 1: *In vitro* evaluation of different contact fungicides against *C. fimbriata*

Conclusion

At all concentrations (0.10%, 0.20%, and 0.30%, respectively), captan, mancozeb, ziram, thiram, and zineb reported the greatest inhibition of mycelial growth *in vitro* experiments against *C. fimbriata*.

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