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Vidyashankar D

Department of Plant Pathology,
College of Agriculture, Dharwad
University of Agricultural
Sciences, Dharwad, Karnataka,
India

BC Kamanna

Department of Plant Pathology,
College of Agriculture, Dharwad
University of Agricultural
Sciences, Dharwad, Karnataka,
India

P Nagaraju

Department of Plant Pathology,
College of Agriculture, Dharwad
University of Agricultural
Sciences, Dharwad, Karnataka,
India

Corresponding Author:**Vidyashankar D**

Department of Plant Pathology,
College of Agriculture, Dharwad
University of Agricultural
Sciences, Dharwad, Karnataka,
India

In vitro efficacy of combi product fungicides against *Magnaporthe oryzae* causing blast of rice

Vidyashankar D, BC Kamanna and P Nagaraju

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Abstract

Blast of rice has observed as the devastating disease affecting both grain and fodder production in rice. Many fungicides have been considered in the past to manage blast of rice, but combi product fungicides are the better option. Six combi product fungicides were evaluated at three concentrations (500 ppm, 1000 ppm and 1500 ppm) under *in vitro* condition by poisoned food technique against *Magnaporthe oryzae* in Department of Plant Pathology, Collage of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka, India. The results showed that, out of six fungicides tested four fungicides viz., tebuconazole 50% + trifloxystrobin 25%, hexaconazole 4% + zineb 68%, carbendazim 12% + mancozeb 63%, captan 70% + hexaconazole 5% at all three concentrations and tricyclazole 18% + mancozeb 62% at 1500 ppm have recorded cent per cent mycelial growth inhibition. Least per cent mycelial growth inhibition (76.47%) was recorded in tricyclazole 18% + mancozeb 62% at 500 ppm concentration.

Keywords: Rice, blast, mycelial growth inhibition, combi product fungicides, *Magnaporthe oryzae*

Introduction

Rice blast caused by *Magnaporthe oryzae* Couch and (Anamorph: *Pyricularia oryzae* Cavara) formally known as *Magnaporthe grisea* Herbert [Anamorph: *Pyricularia grisea* (Cooke) Sacc.] is the causal agent of the blast disease of rice (Couch and Khon, 2002) [3]. The pathogen belongs to Sub-division: Deuteromycotina, Class: Hyphomycetes, Order: Moniliales and Family: Dematiaceae. Annual yield loss caused by this fungus during 90's had been estimated at 35 per cent worldwide (Oerke and Dehne 2004) [8]. Rice blast was first reported as rice fever disease in China by Soon ying-shin in 1637 (Ou and Nuque, 1985) [9], Rice blast is a serious apprehension in temperate areas as well as in tropical uplands, such as those found in West Africa, Iran (Mousanejad *et al.*, 2010) [5], Malaysia and the savannas of South America (Bonman *et al.*, 1986) [1]. It is strewn in almost about in 85 countries all over the world.

The pathogen is flexible to adverse environmental conditions of wide unsteady temperatures and ratio. It seems in irrigated low land or rain fed upland rice additionally as in submerged or problem rice. Between 1980 and 1987, seven epidemics of blast occurred in four states, two every in Himachal Pradesh, Madras and one in Haryana, inflicting serious losses (Nagarajan, 1988) [6].

Plant Pathologists across the world have investigated the potential of typical fungicides like carbendazim, ediphenphos, thiophanate methyl *etc.* for the management of rice blast under field conditions. Many fungicides fail to control the disease effectively. However, there's have to be compelled to confirm the effectiveness of new introduced triazole, strobilurin and combi product fungicides against the fungus in laboratory conditions and their effectiveness to see the disease under artificial epidemic conditions within the field. So this *in vitro* study was conducted to test the new group of combi product fungicides against the fungus.

Material and Methods

The efficacy of combi product fungicides was assayed. The fungicides were tested against the *M. oryzae* by following 'Poisoned food technique'. The required concentrations of chemicals were weighed and incorporated into sterilized, cooled potato dextrose agar. Twenty ml of cooled molten medium was poured into 90 mm sterilized Petri dishes and all plates were inoculated with actively growing five mm mycelial disc of pathogen separately.

Three replications were maintained for each treatment. These plates were incubated at 27 ± 1 °C for 12-14 days, and colony diameter was recorded. The per cent inhibition of mycelial growth was calculated by using the formula given by Vincent (1947) ^[12].

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

Where:

I = Per cent inhibition of mycelial growth

C = Growth of mycelium in control.

T = Growth of mycelium in treatment.

List of fungicides used for *in vitro* evaluation

The following systemic fungicides were evaluated at 500, 1000 and 1500 ppm concentrations.

Sl. No.	Common name	Trade name
1.	Captan 70% + Hexaconazole 5%	Taqat 75% WP
2.	Carbendazim 12% + Mancozeb 63%	Saaf 75% WP
3.	Hexaconazole 4% + Zineb 68%	Avtar 72% WP
4.	Azoxystrobin 14.4% + Propiconazole 11.4%	Headway 25.8% G
5.	Tebuconazole 50% + Trifloxystrobin 25%	Nativo 75% WG
6.	Tricyclazole 18% + Mancozeb 62%	Merger 80% WP

Results and Discussion

Efficacy of six combi product fungicides was tested at three different concentrations by poison food technique as per the procedure explained in Material and Methods. The results obtained on testing efficacy of fungicides against the *M. oryzae* are depicted in Table 1 and Plate 1.

Among the six combi product fungicides tested, four fungicides viz., tebuconazole 50% + trifloxystrobin 25%, hexaconazole 4% + zineb 68%, carbendazim 12% + mancozeb 63%, captan 70% + hexaconazole 5% at all three concentrations and tricyclazole 18% + mancozeb 62% at 1500 ppm have recorded complete mycelial growth inhibition. Least per cent mycelial growth inhibition (76.47%) was recorded in tricyclazole 18% + mancozeb 62% at 500 ppm

concentration (Fig. 1). The results obtained are in agreement with the findings of Neelakanth *et al.* (2017), Kulmitra *et al.* (2017) ^[4] and Suman Dutta (2017) ^[11], they obtained highest mycelial growth inhibition in combi fungicides like carbendazim 12% + mancozeb 63% and tebuconazole 50% + trifloxystrobin 25%. Combi fungicides are the best in control of plant diseases and avoid development of fungicide resistance. Combi fungicides contain one contact and one systemic fungicide or two systemic fungicides with different mode of action. Fungi can develop resistance to one fungicide by point mutation but can't develop resistance to two fungicides with different mode of action at once (Bosch *et al.*, 2014) ^[2].

Table 1: *In vitro* evaluation of combi product fungicides against *M. oryzae*

Treatment	Fungicide	Per cent mycelia growth inhibition			Mean
		500 ppm	1000 ppm	1500 ppm	
T ₁	Tebuconazole 50% + Trifloxystrobin 25%	100.00 (90.00)*	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)
T ₂	Hexaconazole 4% + Zineb 68%	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)
T ₃	Carbendazim 12% + Mancozeb 63%	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)
T ₄	Captan 70% + Hexaconazole 5%	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)
T ₅	Tricyclazole 18% + Mancozeb 62%	76.47 (60.98)	86.67 (68.59)	100.00 (90.00)	87.71 (69.48)
T ₆	Azoxystrobin 14.4% + Propiconazole 11.4%	89.41 (71.01)	91.37 (72.92)	99.22 (84.93)	93.33 (75.03)
Mean		94.31 (76.20)	96.34 (78.97)	99.87 (87.93)	
		S.Em. ±	C.D. @ 1%		
Fungicide (F)		0.28	0.79		
Concentration (C)		0.20	0.56		
Fungicide × Concentration		0.48	1.38		

*Arc sine transformed values

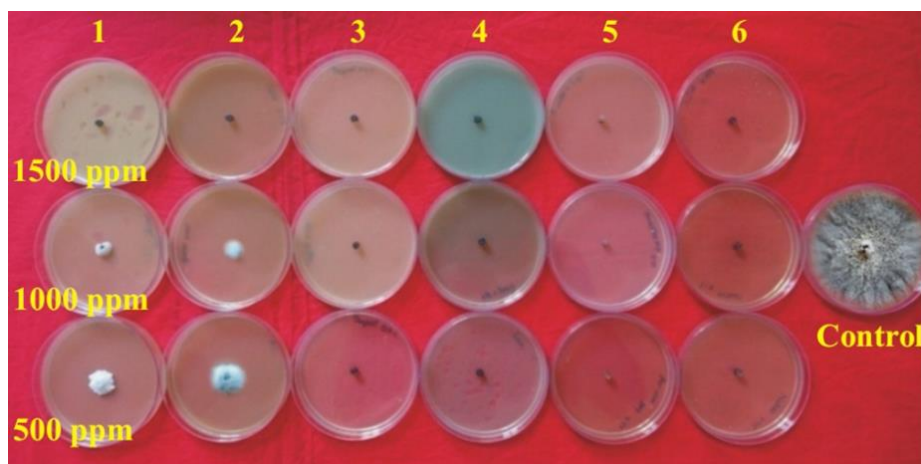


Plate 1: *In vitro* efficacy of combi product fungicides against *M. oryzae*

Conclusion

In vitro effectiveness of six combi product fungicides at three different concentrations tested against *M. oryzae*. The obtained results revealed that, in all the concentrations tested four fungicides viz., tebuconazole 50% + trifloxystrobin 25%, hexaconazole 4% + zineb 68%, carbendazim 12% + mancozeb 63%, captan 70% + hexaconazole 5% have shown cent per cent mycelial growth inhibition over control.

Acknowledgement

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