

Original Research Article

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Evaluation of Bio-efficiency of Rice Based Fungicides against Rice Discoloration Causing Pathogen *Curvularia lunata* (Wakker) Boedijn

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ABSTRACT

Keywords

Carbendazim, Mancozeb, *Curvularia lunata* and Per cent inhibition

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In the present investigation efforts were made to evaluate different rice based fungicides viz; Trifloxystrobin (25%) + Tebuconazole (50%) WG, Tebuconazole (25.9%) EC, Carbendazim (50%) WG, Propiconazole (25%) EC, Hexaconazole (5%) EC and Mancozeb (63 % WP) against the mycelial growth of rice grain discoloration causing pathogen *Curvularia lunata*. Among all the fungicides tested, Trifloxystrobin (25%) + Tebuconazole (50%) WG and Tebuconazole proved to be completely effective in inhibiting the growth of the pathogen at low concentrations i.e., 1000, 800 and 400 and 1000, 750 and 500 respectively compared with other fungicides and control.

Introduction

Rice (*Oryza sativa* L.) is the primary staple food in many countries. In India it is cultivated in an area of 44 M ha with 105 M T of production and 2386 kg ha⁻¹ of productivity. In Andhra Pradesh, the area under cultivation of rice is approximately 1.79 M ha with 5.54 M T of production and 2381 kg ha⁻¹ of productivity (Govt. of India, Ministry of Agriculture, Dept. of Agriculture & Cooperation, Directorate of Economics & Statistics, 2016).

Seed (or) grain discoloration is an early indication of poor seed or grain quality which is generally associated with micro-organisms

and sometimes insect pests. Such grains are of poor market value and low consumption quality due to degradation in nutritional value. It was reported as an independent disease in the literature causing significant yield losses (Ashfaq *et al.*, 2013; Chandramani and Awadhiya 2014). It is becoming a serious problem in parts of Asia and resulting in the yield reduction of rice (Arshad *et al.*, 2009).

Grain discoloration of rice is a complex disease occurred, due to infection by certain microorganisms on glumes, kernels or both. The disease is causing both qualitative and quantitative losses of grain yield and also results in seedling mortality, reduction in germination and seedling vigour. Except for

other factors several microorganisms especially fungi play a major role in the development of this disease. Under humid conditions, the fungal growth may be prominently seen.

Two groups of fungi are associated in grain discoloration of rice (Ou, 1985). One group is field fungi, more or less parasitic and infects grain before harvest like *Drechslera oryzae*, *Pyricularia oryzae*, *Alternaria padwickii*, *Fusarium moniliforme*, *Curvularia geniculata*, *Sarocladium oryzae* etc. Other groups are storage molds, saprophytes viz., *Aspergillus* sp., *Penicillium* sp., *Mucor* sp., *Rhizopus* sp. etc.

The seed-borne inoculum of *A. alternata* is responsible for ashy grey discoloration and *D. oryzae* (*Cochliobolus miyabeanus*) is responsible for black discoloration, dark brown spots and light to dark brown dot like spots are found in the seed coat and endosperm of discolored seed.

Whereas, *C. geniculata* (*Cochliobolus geniculatus*) found responsible for eye shaped spots. Besides, *F. equiseti*, *F. oxysporum* (*Gibberella zeae*), *F. moniliforme* (*Gibberella fujikuroi*) found responsible for pink discoloration and *S. oryzae* is responsible for light brown discoloration on the seed coat, endosperm and embryo of discolored seed (Sachan and Agrawal, 1994).

Management of disease by application of different chemicals at different stages of flowering had been reported by different researchers (Arunyanant *et al.*, 1981).

Presently so many chemical measures are in practise for the management of grain discoloration.

Grain discoloration is the complex disease so many fungi responsible for the disease so,

Integrated Disease Management strategies including fungicides application necessary to check the disease.

Karmakar (2016) conducted an experiment at farmer's fields to test the efficacy of seven fungicides against grain discoloration. Among the fungicides tested, five fungicides found effective in reducing disease *i.e.*, Trifloxystrobin 25 % + Tebuconazole 50 % WG was found to be best performing fungicide with minimum level of PDI. The other four fungicides namely Carbendazim 25 % + Mancozeb 50 % WS, Tricyclazole 18 % + Mancozeb 62 % WP, Tricyclazole 75 % WP, Propiconazole 13.9 % + Difenconazole 13.9 % EC had significant role in reducing PDI and percentage of disease infected seeds.

Balgude and Gaikwad (2016) reported that three sprays of fungicide combination viz., Trifloxystrobin 25 % + Tebucanazole 50 % (0.04 %) at 15 days interval starting first spray immediately after disease appearance were found to be most effective in management of grain discoloration disease and thereby enhancing the grain yield in paddy compared to Tricyclazole (0.06 %), Propicanazole (0.10 %) and Carbendazim (0.10 %).

Materials and Methods

In order to study the antifungal effect of certain fungicides in the management of rice grain discoloration, an experiment was conducted by following poisoned food technique (Nene and Thapliyal, 1993). Different fungicides and their concentrations used for the study mentioned in Table 2.

The effect of different fungicides, plant extracts and natural compounds mentioned in the above tables were evaluated against the predominant grain discoloration fungal pathogen by poisoned food technique as described by Nene and Thapliyal (1993).

Different concentrations of fungicides were prepared separately. The experiment was laid out in Completely Randomized Design (CRD) with seven treatments and three replications. For each treatment, 60 ml of PDA medium transferred to 100 ml conical flask and sterilized in autoclave. To this medium, required concentration of fungicides, plant extracts and natural compounds were separately added, mixed thoroughly and then poured into Petri plates, finally allowed to solidify. From seven-day old culture of pathogen, a five mm disc cut from outer margin with the sterilized cork borer and was transferred to the center of the plates containing the medium amended with test compound. Appropriate control was maintained by placing fungal discs in unamended plates and incubated at $25\pm 1^{\circ}\text{C}$. The whole procedure was carried out under aseptic conditions.

The growth of fungal colony was measured after observing the full plate growth in control. The per cent inhibition was calculated by following the formula given by Vincent (1927).

$$I = (C - T)/C \times 100$$

Where I= Per cent Inhibition

C= Radius of the colony of fungus in control

T= Radius of the colony of fungus in treatment.

Results and Discussion

In order to assess the effect of different fungicides viz; Trifloxystrobin (25%) + Tebuconazole (50%) WG, Tebuconazole (25.9%) EC, Carbendazim (50%) WG, Propiconazole (25%) EC, Hexaconazole (5%) EC and Mancozeb (63 % WP) on the mycelial growth of grain discoloration caused by predominantly occurred pathogen *C. lunata*

poisoned food technique was used. Observations on radial growth were recorded after control plate fully occupied by pathogen. Percent inhibition over control was calculated and results were presented in the Table 1, Figure 1a to 1c.

While, Trifloxystrobin (25%) + Tebuconazole (50%) WG combination and Tebuconazole (25.9 EC) were highly effective in inhibiting the mycelial growth of the pathogen. All the four concentration of Trifloxystrobin (25%) + Tebuconazole and Tebuconazole showed significantly complete inhibition (100 %) in the mycelial growth of the pathogen.

However, Mancozeb (63 % WP) at 2000 ppm concentration showed complete inhibition in the mycelial growth and at 1500, 1000 and 500ppm concentrations it was showed 94.44, 88.81 and 83.96 per cent inhibition respectively.

Whereas, Carbendazim (50%) WG showed complete inhibition at 1000 and 750 ppm. At 500 and 250 ppm it showed 83.85 and 77.04 per cent inhibition respectively.

While, Hexaconazole (5% EC) showed significantly higher inhibition (74.22%) at 2000 ppm and has efficacy was decreased with decrease in concentration i.e., 69.15 per cent at 1500 ppm and 65.19 per cent at 1000 ppm. Lowest inhibition (60.67%) was recorded at 500 ppm.

However, Propiconazole (25% EC) exhibition significantly higher inhibition (57.15%) at 1000 ppm followed by 55.93 per cent at 750 ppm and 53.92 per cent at 500 ppm. Lowest inhibition per cent (50.48%) was observed at 250 ppm.

All the concentrations of six fungicides were significantly differed with control.

Table.1 Evaluation of bio efficacy of fungicides against *C. lunata* using poisoned food technique

S. NO	Treatments	Concentrations	Radial Growth (cm)**	% Inhibition
1.	Mancozeb (63%) WP	500ppm	1.44	83.96 (66.37)
		1000ppm	1.01	88.81 (70.44)
		1500ppm	0.47	94.74 (76.72)
		2000ppm	0.00	100.00 (90.00)
2.	Carbendazim (50%) WG	250ppm	2.07	77.04 (61.35)
		500ppm	1.45	83.85 (66.28)
		750ppm	0.00	100.00 (90.00)
		1000ppm	0.00	100.00 (90.00)
3.	Hexaconazole (5% EC)	500ppm	3.54	60.67 (51.14)
		1000ppm	3.13	65.19 (53.82)
		1500ppm	2.78	69.15 (56.24)
		2000ppm	2.32	74.22 (59.46)
4.	Propiconazole (25% EC)	250ppm	4.46	50.48 (45.26)
		500ppm	4.15	53.92 (47.23)
		750ppm	3.97	55.93 (48.38)
		1000ppm	3.86	57.15 (49.09)
5.	Tebuconazole (25.9% EC)	250ppm	0.00	100.00 (90.00)
		500ppm	0.00	100.00 (90.00)
		750ppm	0.00	100.00 (90.00)
		1000ppm	0.00	100.00 (90.00)
6.	Trifloxystrobin (25%) + Tebuconazole (50%) WG	200 ppm	0.00	100.00 (90.00)
		400ppm	0.00	100.00 (90.00)
		800ppm	0.00	100.00 (90.00)
		1000ppm	0.00	100.00 (90.00)
7.	Control		9.00	0.00 (0.00)
	C.D (P=0.05)		0.064	0.72
	SEm(±)		0.023	0.25
	SE(d)		0.032	0.36
	C.V(%)		2.244	0.54

Table.2 Different fungicides and their concentrations used

S.No	Fungicide name	Concentrations used	Trade name
1.	Trifloxystrobin (25%) + Tebuconazole (50%) WG	1 g/lit	Nativo (Bayer Crop Sciences)
2.	Hexaconazole (5% EC)	2 ml/lit	Contaf (Tata Rallis)
3.	Mancozeb (75% WP)	2 g/lit	Dithane M-45 (Indofil)
4.	Propiconazole (25% EC)	1 ml/lit	Tilt (Syngenta)
5.	Carbendazim (50% WP)	1 g/lit	Bavistin (Indofil)
6.	Tebuconazole (25.9% EC)	1 ml/lit	Folicur (Bayer Crop Sciences)

Fig.1a Evaluation of bio efficacy of fungicides (Mancozeb, Hexaconazole) against *C. lunata* using poisoned food technique

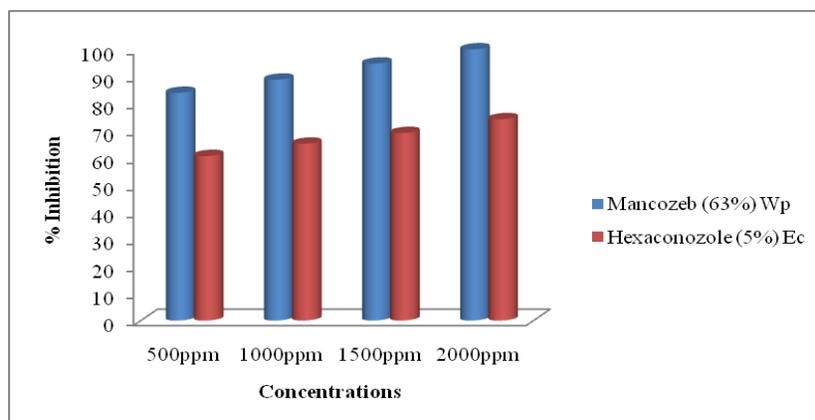


Fig.1b Evaluation of bio efficacy of fungicides (Tebuconazole, Carbendazim, Propiconazole) against *C. lunata* using poisoned food technique

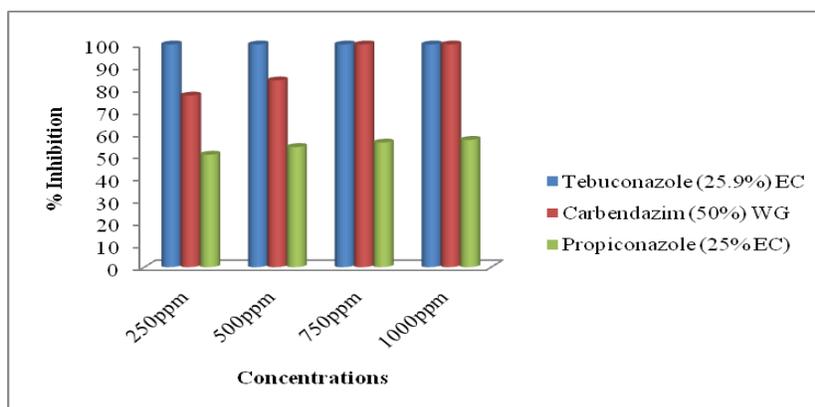
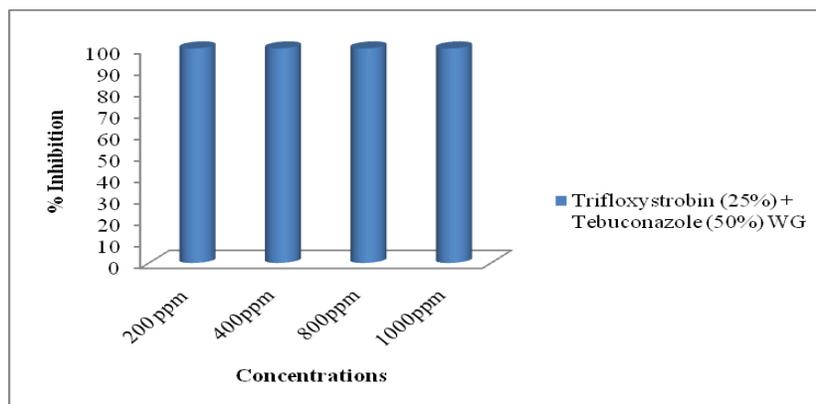


Fig.1c Evaluation of bio efficacy of fungicide (Trifloxystrobin (25%) + Tebuconazole (50%) WG against *C. lunata* using poisoned food technique



Among all the fungicides tested, Trifloxystrobin (25%) + Tebuconazole (50%) WG and Tebuconazole 925%) EC proved to be completely inhibiting the growth of the pathogen at all the four concentrations imposed. Based on the above results, these two fungicides were found to be effective and used for further field studies.

These results were in agreement with the work done by Arshad *et al.* (2009) who isolated eight fungi namely *B. oryzae*, *A. alternata*, *A. padwickii*, *D. oryzae*, *F. moniliforme*, *C. lunata*, *N. oryzae* and *A. niger* were isolated from diseased samples.

Four fungicides *viz.* Mancozeb, Ridomil, Topsin-M and Carbendazim were checked for the control of pathogens. Mancozeb and Ridomil showed best control over mycelial growth of all isolated pathogens except *F. moniliforme* where Carbendazim was found the best followed by Topsin M, Mancozeb and Ridomil respectively.

This study summarises and concludes as follows:

Totally six rice based fungicides *viz.*; Trifloxystrobin (25%) + Tebuconazole (50%) WG, Tebuconazole (25.9%) EC,

Carbendazim (50%) WG, Propiconazole (25%) EC, Hexaconazole (5%) EC and Mancozeb (63 % WP) evaluated against the mycelial growth of predominantly occurred pathogen *F. moniliforme*. Among all the fungicides tested, Trifloxystrobin (25%) + Tebuconazole (50%) WG and Tebuconazole proved to be completely effective in inhibiting the growth of the pathogen at low concentrations i.e., 1000, 800 and 400 and 1000, 750 and 500 respectively compared with other fungicides. Based on the above results, these two fungicides were found to be effective and used for further field studies.

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