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New Group of Fungicides as the Potential Source of Management of Leaf Spot and Flower Blight of Marigold

Rakesh Roshan Satapathy[1], Kartik Chandra Sahoo[1]

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ABSTRACT

Background: Leaf spot and flower blight caused by *Alternaria zinniae* is serious disease of marigold causing yield loss of 50-60% in crop. Many previously used fungicides showed resistance against the pathogen. So the present investigation was carried out with an objective to study the efficacy of new fungicides available in the market using poison food technique.

Methods: Eleven fungicides such as azoxystrobin, tebuconazole, azoxystrobin + tebuconazole, difenoconazole, azoxystrobin + difenoconazole, tebuconazole + sulphur, wettable sulphur, mancozeb, metalaxly, chlorothalonil, chlorothalonil + metalaxly were evaluated at the concentration of 0.1%, 0.15% ,0.1%, 0.1%, 0.1%, 0.15%, 0.25%, 0.3%,0.2%, 0.3% and 0.3% respectively.

Result: The present investigation revealed that Azoxystrobin + Tebuconazole recorded maximum mycelial growth inhibition of 96.85% followed by Tebuconazole + Sulphur 96.40% and Metalaxyl of 95.50%. The least inhibition of 18.92% was recorded by wettable sulphur.

Key words: Alternaria, Azoxystrobin + Tebuconazole, Fungicides, Marigold.

INTRODUCTION

Marigold (*Tagetes erecta* L.), a member of the Tagetes genus in the Asteraceae family and sometimes known as genda phool, is native to Mexico and America. In India, there are fifty kinds of annual and perennial herbaceous plants. In India, marigolds are grown on 8000-10000 hectares of land with a production of 70,000 metric tonnes (Negi *et al*., 1998). Marigold flower has a longer blooming duration and a long shelf life. The flower spreads quickly and they are also recognised for being a fast-growing and annual flowering plant. The plant's height ranges from 6 inches to 3 feet. It is mostly utilised for ornamental and medicinal purposes in India. It's used to treat rheumatism, colds and bronchitis, among other ailments.

Each portion of the plant is prized for its therapeutic properties; the leaves, for example, are commonly used as an antibacterial, to treat kidney problems and to treat piles. The flower has a more ayurvedic composition, making it effective for fever, scabies and liver problems, as well as eye problems. In Mexico, the plant's shoots are often used to make teas. The bioactive component found in the flower has insecticidal and fungicidal properties. The leaves and flowers both have therapeutic properties due to their phenolic and antioxidant activities and they are equally essential in the pharmaceutical business (Tripathy and Gupta 1991; Khalil *et al*., 2007). Marigold essential oil is highly sought after in the perfume industry (Naik *et al*., 2003). Dhenkanala, Koraput, Sambalapur, Sundergah and Balasore are the primary marigold growing districts in Odisha. Except during the hot summer months, productivity is higher.

The most common source of yield loss is diseases caused by fungus, virus and bacteria, as well as nematodes, which cause significant damage and result in yield loss. Fungal diseases that affect marigold plants include flower blight, wilt and stem rot, Alternaria leaf spot and Fusarium wilt. *Alternaria zinniae* causes the most serious disease, blossom blight and leafspot.

For the treatment of the disease, we continue to use traditional fungicides. As a result, resistance to certain fungicides has developed in plant diseases. As a result, plant disease management is getting increasingly challenging. The use of fungicides is more effective than the use of botanical or biological components. Many new fungicides are now available on the market which shows a great efficacy against other diseases. But these fungicides are not tested against this pathogen. In light of these facts, the Department of Plant Pathology, Institute of Agricultural Sciences, Siksha o Anusandhan (deemed to be) University Bhubaneswar, Odisha, conducted research on the evaluation of novel fungicides against plant diseases (India).

MATERIALS AND METHODS

The experiment was carried out in the Department of Plant Pathology, Institute of Agricultural Sciences in the year 2021.

[1]Department of Plant Pathology, Institute of Agricultural Sciences, Siksha 'O' Anusandhan (deemed to be) University, Bhubaneswar-751 030, Odisha, India.

Corresponding Author: Rakesh Roshan Satapathy, Department of Plant Pathology, Institute of Agricultural Sciences Siksha 'O' Anusandhan (deemed to be) University, Bhubaneswar-751 030, Odisha, India. Email: rakeshsatapathy@soa.ac.in

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Using the poisoned food technique, all of the fungicides were bought from the market and tested at specific concentrations. The list of fungicides was mentioned in Table 1. The required chemical concentrations were prepared and mixed into sterilised, cooled potato dextrose agar medium.

Twenty millilitres of media were put into 90 mm sterilised petri dishes and each plate was inoculated with a 5 mm test fungus mycelia disc that was actively growing. For each treatment, three replications were kept. These plates were incubated for seven days at 25±1°C, after which the colony diameter was measured. Vincent's formula was used to calculate the percent inhibition over control (1947).

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

I = Per cent inhibition of mycelium
C = Growth of mycelium in control
T = Growth of mycelium in treatment

Table 1: Different fungicides with their concentration.

Sl. no.	Chemical name	Concentration (%)
T1	Azoxystrobin	0.1
T2	Tebuconazole	0.15
T3	Azoxystrobin + Tebuconazole	0.1
T4	Difenoconazole	0.1
T5	Azoxystrobin + Difenoconazole	0.1
T6	Tebuconazole + Sulphur	0.15
T7	Wet Sulphur	0.25
T8	Mancozeb	0.3
T9	Metalaxyl	0.2
T10	Chlorothalonil	0.3
T11	Chlorothalonil + Metalxyl	0.3

Table 2: *In vitro* bio-assay of fungicides.

Sl. no.	Chemical name	Concentration	Growth inhibition (5%)
T1	Azoxystrobin	0.1	82.88
T2	Tebuconazole	0.15	56.31
T3	Azoxystrobin + Tebuconazole	0.1	96.85
T4	Difenoconazole	0.1	82.88
T5	Azoxystrobin + Difenoconazole	0.1	74.77
T6	Tebuconazole + Sulphur	0.15	96.40
T7	Wet Sulphur	0.25	18.92
T8	Mancozeb	0.3	64.86
T9	Metalaxyl	0.2	95.50
T10	Chlorothalonil	0.3	77.03
T11	Chlorothalonil + Metalxyl	0.3	83.78
	CD	15.977	
	SE (M)	5.413	

RESULTS AND DISCUSSION

It had been found from Table 2 and Fig 1 that Azoxystrobin + Tebuconazole showed the highest inhibition of mycelial growth (96.85%), followed by Tebuconazole + Sulphur (96.40%) and Metalaxly (95.50%). Wettable sulphur had the least inhibition of 18.92 per cent.

Alternaria zinniae causes leaf spot and blossom blight in marigolds, resulting in yield losses of 50-60% in the crop. Many previously used fungicides have been shown to be resistant to the disease. As a result, the current study was carried out with the goal of determining the efficacy of new fungicides available on the market using the poison food technique. Eleven fungicides, including azoxystrobin, tebuconazole, azoxystrobin + tebuconazole, difenoconazole, azoxystrobin + difenoconazole, tebuconazole + sulphur, wettable sulphur, mancozeb, metalaxly, chlorothalonil, chlorothalonil + metalaxly, were tested at Azoxystrobin + Tebuconazole showed the greatest inhibition of mycelial growth (96.85%), followed by Tebuconazole + Sulphur (96.40%) and Metalaxly (95.50%). Wettable sulphur had the lowest inhibition rate of 18.92 per cent. The previous research work showed that mancozeb was the effective fungicide against the disease as Sunita *et al.* (2010) reported that Mancozeb showed maximum growth inhibition of the pathogen. Mancozeb (0.2%) and Carbendazim (0.05%) spray can be used to control the disease at regular intervals (Aktar and Shamsi, 2015). Similarly, Yadav *et al.* (2013) were

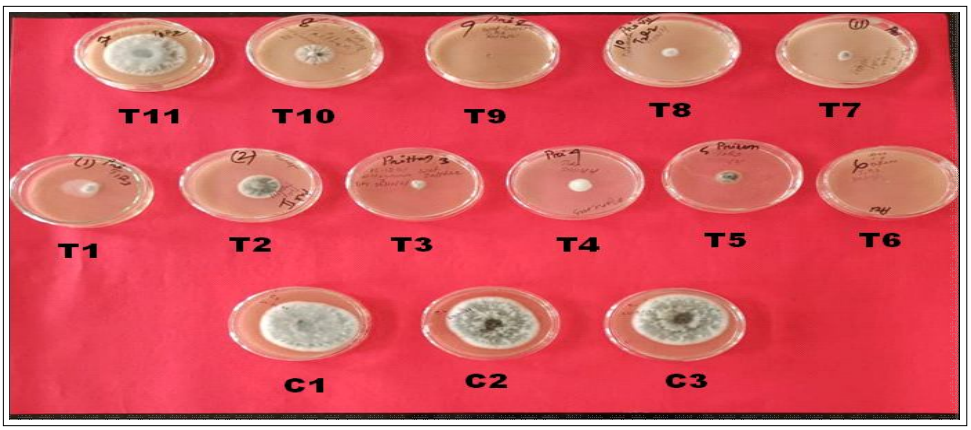


Fig 1: *In vitro* bio-assay of fungicides.

tested different concentration of systemic fungicides in *in vitro* condition and revealed that Hexaconazole was found most effective with highest inhibition of radial growth (98.21%) followed by Propiconazole (97.32%) and Difenoconazole (91.23%).

CONCLUSION

The *in vitro* study on the effect of fungicides on the radial growth of *Alternaria zinniae* revealed that azxysotrobin + tebuconazole (0.1%) recorded maximum inhibition (96.85%) followed by tebuconazole + sulphur (96.40%) followed by metalxyl (95.5%). Wettable sulphur recorded least inhibition (18.92%). These fungicides may be trailed under field condition to know more about its efficacy against the pathogen so that it can be recommended in the farmer field condition.

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Conflict of interest: None.

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