ISSN: 0976-3031

International Journal of Recent Scientific Research

Impact factor: 5.114

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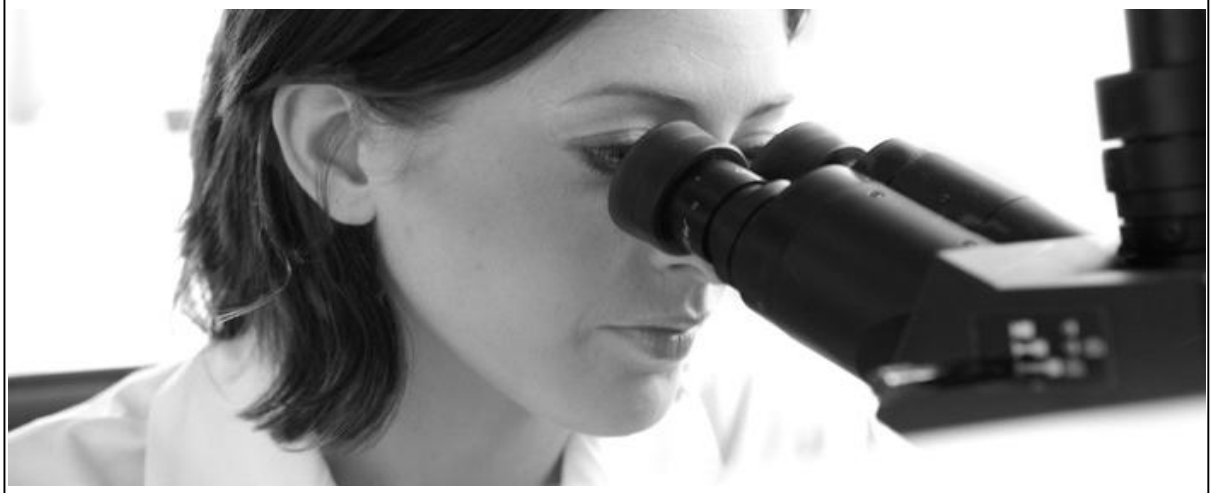

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Volume: 6 Issue: 9

THE PUBLICATION OF
INTERNATIONAL JOURNAL OF RECENT SCIENTIFIC RESEARCH
http://www.recentscientific.com
E-mail: recentscientific@gmail.com

ISSN: 0976-3031

Available Online at http://www.recentscientific.com

International Journal of Recent Scientific Research
Vol. 6, Issue, 9, pp.6519-6521, September, 2015

International Journal of Recent Scientific Research

RESEARCH ARTICLE

EFFICACY OF NON-SYSTEMIC AND SYSTEMIC FUNGICIDES AGAINST PURPLE BLOTCH OF ONION (*ALLIUM CEPA L.*) CAUSED BY *ALTERNARIA PORRI* (*ELLIS*) CIF

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ARTICLE INFO

Article History:

Received 16th June, 2015
Received in revised form 24th July, 2015
Accepted 23rd August, 2015
Published online 28st September, 2015

Key words:

Alternaria porri, purple blotch disease, onion, non-systemic and systemic fungicides.

ABSTRACT

Onion is one of the most important commercial vegetable crops of India. The crop is subjected to attack by a number of diseases, of which purple blotch caused by *Alternaria porri* (Elis.) cif. has been most serious and also a major limiting factor in cultivation of onion causing major economic losses to the farmer. Several and excess of fungicides are being used for the management of this disease that results in economic burden and less than satisfactory results as well as residual problems. In this context, a study was undertaken to evaluate the efficacy of few systemic and non-systemic fungicides against *A. porri* causing purple blotch of onion (*Allium cepa* L.) under *in vitro* conditions.

INTRODUCTION

Onion (*Allium cepa* L.) rightly called as "Queen of Kitchen" is one of the oldest known and an important vegetable crop grown in India. It belongs to the family *Alliaceae*. *Allium* is a large genus comprising of more than 500 spp. of usually perennial bulbous plants; of which *Allium cepa* is the major cultivated species grown all over the world.

In the world, India ranks first in total area of 1064 thousand hectares and ranks second in production after China with total production of 15118 thousand million tonnes with a productivity of 14.2 million tonnes per hectare and contributing for 19.9% of total world production. In India it is cultivated in Maharashtra, Karnataka, Gujarat, Bihar, Madhya Pradesh, Andhra Pradesh, Rajasthan and Haryana (Anon., 2011).

Onion is one of the most widely used vegetables both at mature and immature bulb stage for its flavouring and seasoning of food. Medicinal values of onion are innumerable and is one of the ancient crops being utilized in medicine. To a lesser extent, it is used by processing industry for dehydration in the form of onion flakes and powder, which are in great demand in the world market.

Several factors have been attributed for the low productivity of onion in India; among these diseases are the most important factors. Onion is affected by major disease *viz.*, purple blotch, downy mildew, *Stemphylium* blight, basal rot and storage rots.

Among the foliar diseases, purple blotch is one of the most destructive diseases, commonly prevailing in almost all onion growing pockets of the world, which causes heavy losses in onions under field conditions. Though many researchers have worked on this pathogen and its management the disease still remains a major bottleneck in onion cultivation.

In view of this, an investigation was undertaken by carrying out *in vitro* evaluation of different fungicides for their efficacy against *A. porri* and is most essential so as to incorporate the effective ones in the management package.

MATERIAL AND METHODS

In vitro evaluation of fungicides against Alternaria porri

The efficacy of four non-systemic and four systemic fungicides was evaluated under *in vitro* conditions against *Alternaria porri* for inhibition of radial growth on the PDA (which supported

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the maximum mycelial growth of *Alternaria porri*) using Poisoned Food Technique (Sharvelle, 1961). The non-systemic fungicide was evaluated at 0.1, 0.2 and 0.3 per cent concentrations, whereas systemic fungicides were tested at 0.05, 0.1 and 0.15 per cent concentrations.

The requisite quantities of fungicides were incorporated aseptically to PDA medium cooled to 45^{o}C, so as to, give the required concentrations. Twenty milli litre of the poisoned medium was poured into flat–bottomed sterile Petri dishes. The plates were then inoculated by cutting half cm of 14 days old mycelial discs of *Alternaria porri* with a sterile Cork borer and incubated at 28±1^{0}C. Three replications were maintained for each treatment. The fungus growth on the PDA without any fungicide served as control. The radial growth (mm) of the colony was recorded when maximum growth (14 days) in control plates was noticed. The per cent inhibition of the mycelial growth of the fungus was determined by using the Vincent's formula (Vincent, 1947). The percent values were converted into angular transformations, the data were analyzed statistically.

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

Where, I = Per cent inhibition
C = Radial growth in control
T = Radial growth in treatment (fungicide)

RESULTS AND DISCUSSION

Evaluation of fungicides *in vitro* is a handy tool to screen large number of fungicides at different concentrations. In the present study, the laboratory evaluation of fungicides by poison food technique revealed that among the non-systemic fungicides evaluated (Table 1) *in-vitro* against *A porri*,mancozeb 75WP gave maximum inhibition (89.51%) of the mycelial growth of the pathogen and next best was propineb 70%WP (86.30%) and they were on par with each other, followed by chlorothalonil (84.94%). Zineb (78.15%) which showed least percent inhibition among different fungicides tested.

Table 1 *In vitro* evaluation of non-systemic fungicides against *A. porri*

Sl No	Fungicides	Per cent inhibition at different concentrations' (%)**			
		0.1	**0.2**	**0.3**	**Mean**
1	Chlorothalonil (Kavach 75%WP)	73.33 (58.91)	86.30 (68.29)	95.19 (77.44)	84.94 (68.21)*
2	Zineb (Indofil Z-78 75% WP)	66.30 (54.67)	82.22 (65.08)	85.93 (68.05)	78.15 (62.60)
3	Mancozeb (Agastya M- 45 75%WP)	84.07 (66.51)	87.41 (69.27)	97.04 (80.22)	89.51 (72.00)
4	Propineb (Antracol 70% WP)	81.11 (64.24)	87.04 (68.94)	90.74 (72.40)	86.30 (68.52)
	Mean	76.20 (61.08)	85.74 (67.89)	92.22 (74.53)	84.72 (67.83)
	Sources of variance	S. Em±		CD at 1%	
	Fungicide(F)	0.89		3.52	
	Concentrations (C)	0.77		3.05	
	F X C	1.54		NS	

*****Figures in parentheses indicate angular transformations.
** In comparison with control showing 9.0 cm growth.

Table 2 *In vitro* evaluation of systemic fungicides against *A. porri*

Sl No	Fungicides	Per cent inhibition at different concentrations (%)**			
		0.05	**0.1**	**0.15**	**Mean**
1	Hexaconazole (Contaf 5 EC)	88.15 (70.36)	90.00 (71.57)	95.19 (77.43)	91.11 (73.12)*
2	Tebuconazole (Folicur 25 EC)	72.22 (58.18)	83.70 (66.25)	86.67 (68.61)	80.86 (64.35)
3	Propiconazole (Tilt 25 EC)	88.15 (69.87)	91.48 (73.02)	98.15 (83.62)	92.59 (75.50)
4	Difenconazole (Score 25 EC)	74.44 (59.65)	88.89 (70.57)	95.56 (77.88)	86.30 (69.37)
	Mean	80.74 (64.52)	88.52 (70.35)	93.89 (76.89)	87.72 (70.59)
	Sources of variance	S. Em±		CD at 1%	
	Fungicide(F)	0.95		3.78	
	Concentrations (C)	0.82		3.27	
	F X C	1.65		NS	

*****Figures in parentheses indicate angular transformations.
** In comparison with control showing 9.0 cm growth.

The study revealed that there is a significant difference among the concentrations tested to inhibit the radial growth of pathogen. Of them, concentration at 0.3 per cent inhibited maximum radial growth of the pathogen (92.22%) which was found to be significantly superior over other two concentrations *viz*., 0.2 per cent (85.74%) and 0.1 per cent (76.20%).

However, there was no significant interaction effect between fungicides and concentrations noted. These results are in confirmation with Rahman *et al.* (1988), they evaluated different fungicides against the purple blotch of onion, among them mancozeb was reported as the best fungicide for the management of the disease.

Similar results were reported by Chethana *et al*. (2011) and they opined that among the non-systemic fungicides mancozeb at 0.3 per cent was best in inhibiting the growth of *Alternaria porri* with 100 percent inhibition.
Chethana *et al*. (2012) reported that among the fungicides, mancozeb and propineb (0.3%) caused 100 per cent inhibition of mycelial growth. Madhavi *et al*. (2012) reported that out of the five fungicides tested, mancozeb was highly effective followed by blitox and benlate. Mishra and Gupta (2012) revealed that mancozeb at 0.2% was found most effective in inhibiting the growth of *A. porri.*

Among the systemic fungicides evaluated (Table 2) *in-vitro* against *A porri*, propiconazole 25 ECgave maximum inhibition (92.59%) of the mycelial growth of the pathogen and next best was with the hexaconazole 5 EC 70% gave inhibition (91.11%) and were on par with each other, followed by difenconazole 25 EC (86.30%) and tebuconazole 25 EC showed least percent inhibition (80.86%).

The study revealed that there was a significant difference among the concentrations tested to inhibit the radial growth of pathogen. Of them, concentration at 0.15% gave maximum inhibition (93.89%) which was found to be significantly superior over concentration at 0.1 per cent (88.52%) and 0.05 per cent (80.74%).

There were no significant differences in interaction effect of the fungicides and concentrations. The present findings are in contrast to Chethana *et al*. (2011), they reported that among systemic fungicides tested difenconazole at 0.1 per cent showed 98.85 per cent inhibition of the *Alternaria porri*. But in confirmation with findings of Mishra and Gupta (2012), they reported that out of eight fungicides evaluated, propiconazole (0.1%) proved to be best and followed by hexaconozole against *Alternaria porri*. These varying results may be attributed to the existance of races in *A. porri*.

CONCLUSION

Totally four treatments were used in non-systemic fungicides such as chlorothalonil, zineb, mancozeb and propineb. Of them, mancozeb 75WP gave maximum inhibition (89.51%) of the mycelial growth of the pathogen and next best was propineb 70%WP (86.30%) followed by chlorothalonil (84.94%) and zineb (78.15%). In case of systemic fungicides, four treatments were evaluated such as hexaconazole, tebuconazole, propiconazole and difenconazole. Maximum inhibition of mycelia growth was obtained in propiconazole (92.59%) and next best was with the hexaconazole (91.1%) followed by difenconazole (86.30%) and tebuconazole (80.86%).

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How to cite this article:

Priya R.U., Arun Sataraddi and Darshan, S.2015, Efficacy of Non-Systemic and Systemic Fungicides Against Purple Blotch of Onion (Allium Cepa l.) Caused by Alternaria Porri (Ellis) Cif. *Int J Recent Sci Res*, 6(9), 6519-6521.

International Journal of Recent Scientific Research

ISSN 0976-3031