



Research Article

EFFICACY OF BUPIRIMATE 25% EC AGAINST ROSE POWDERY MILDEW

KUMAWAT MAHESH K.<sup>1\*</sup>, CHANDARN NEETHU K.<sup>2</sup> AND SRIRAM S.<sup>2</sup>

<sup>1</sup>Department of Microbiology, Jain University, 3<sup>rd</sup> Block, Jayanagar, Bengaluru, 560011

<sup>2</sup>Division of Plant Pathology, ICAR-Indian Institute of Horticultural Research, Hessaraghatta Lake Post, Bengaluru, 560089

\*Corresponding Author: Email-maheshkumawat88@gmail.com

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**Abstract-** Powdery mildew is a serious fungal disease of ornamental crops especially rose and it can plant stand, flower quality and yield. In this study, we have evaluated the efficacy of Bupirimate 25% EC for its efficacy against powdery mildew of rose. Bupirimate25% ECwas used at a concentration of 2, 4, and 6 ml/L with Carbendazim 50% WP1 g/ plant in 2 L for comparison at 7days interval for two seasons. Bupirimate 25% EC at 4ml/L and 6ml/L reduced disease incidence and resulted in higher yield compared to Bupirimate 25% EC 2 ml/L and Carbendazim 50% WP@ 1g/L. Bupirimate25% EC at any concentration didn't show any phytotoxicity on rose plants.

**Keywords-** Rose, Powdery mildew, Bupirimate, Management.

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Introduction

Powdery mildew is undoubtedly the most widespread disease of roses. The pathogen, *Sphaerotheca pannosa* var. *rosae*, appears as a white or grey powdery or cottony coating on the leaves, tender stems, and flower buds. It distorts and discolors the infected areas, causes defoliation, and consecutively reduces plant vigor [1-4]. Roses are one of the most popular flowering shrubs in India. Powdery mildews seldom kill their hosts but utilize their nutrients, reduce photosynthesis, impair growth and reduce quality yields [5]. Many fungicides have been used for the management of powdery mildews. Among the systemic fungicides used strobilurins (azoxystrobin, trifloxystrobin and kresoxim methyl) and sterol biosynthesis inhibitors like triazoles, imidazoles and pyrimidines (Fenarimol, Cyproconazole, Flusilazol, Tetraconazole, Tebuconazole, Triadimenol) are commonly used. However, there is threat of fungicide resistance to this single site targeting fungicides. The alternate group of fungicides is Bupirimates. The target site for Bupirimates is Adenosine-deaminase (ADAase). The resistance to this group is governed by multiple genes. Hence, they can be included as alternate chemical in management of powdery mildews along with strobilurins and SBIs. The present experimental study was taken up with the objective of evaluating efficacy of Bupirimate 25% EC against Powdery Mildew in Roses.

Materials and Methods

A field experiment was conducted for two seasons during 2013 and 2014 at the Indian Institute of Horticultural Research, Bangalore. Bupirimate 25% EC, a product of M/s Makhateshim-Agan India Pvt. Ltd., was evaluated against powdery mildew disease of rose. The experiment was taken up in a Randomized Block Design with four replications of each treatment. Rose variety "First Red" was grown in a naturally ventilated polyhouse (50 m x 30 m) on raised beds of one-meter width and planted at a spacing of 45cm x 30cm. Application was made at the time of first appearance of disease (powdery mildew) during flower buds emergence. The disease severity was expressed as percent incidence of disease

[6]. The scoring of powdery mildew was done based on the following rating scheme:

Rating scale for assessment of Powdery mildew

Grade	Description of symptoms
0	No symptom on any plant
1	Small powdery specks on the leaves covering 1% or less area
3	Powdery lesions small, scattered covering 1 – 10% of leaf area
5	Powdery patches big, scattered covering 11 – 25% of the leaf area
7	Powdery patches big, coalescing covering 26 – 50% of leaf area
9	Powdery growth covering 51% or more of leaf area. Leaf turn yellow and dry up.

The intensity of powdery mildew was calculated by using the following formula:

$$\text{Per cent disease incidence (PDI)} = \frac{\sum \text{Disease Scores}}{\text{Number of plants Assessed} \times \text{Maximum Disease Score}} \times 100$$

The fresh flower yield in each plot at every plucking time was recorded and total harvested quantity was estimated and it was expressed as Q/ha.

Treatment Details

Table-1 Treatment details for bio efficacy and phytotoxicity studies

S. No.	Treatment	Dosage (ml or gm/ha)			Formulation (ml /gm per liter of water)
		a. i. (g)	Formulation (ml or gm per ha)	Water volume/ha (lit)	
1.	Bupirimate25% EC	500	2000ml	1000	2ml/L water
2.	Bupirimate25%EC	1000	4000ml		4ml/L water
3.	Bupirimate 25% EC	1500	6000ml		6ml/L water
4.	Bupirimate 25%EC	2000	8000ml		8ml/L water
5.	Carbendazim 50% WP	250	500gm		1 g/ 2 L water
6.	Control	-	-	-	-

Three applications of treatments [Table-1] were applied as foliar sprays at 10-day interval using knapsack sprayer fitted with hollow cone nozzle. The spray schedule was started on the appearance of diseases symptoms. Each treatment consisted of 16 rose plants and had four replications. The disease incidence was recorded before first spray and 7 days after each spray. The values were subjected to statistical analysis for comparison of results. From each treatment, five plants were taken at random for disease incidence assessment. The plants were observed for symptoms of Phytotoxicity viz., yellowing, wilting, necrosis, vein clearing, epinasty and hyponasty after 1, 3, 5, 7 and 10 days of each spray. Phytotoxicity parameters were recorded based on a scale of 0-10 [Table-2].

**Table-2** Scale for Phytotoxicity evaluation

Scale	Phytotoxicity (%)
0	0 – 00
1	1 – 10
2	11 – 20
3	21 – 30
4	31 – 40
5	41 – 50
6	51 – 60
7	61 – 70
8	71 – 80
9	81 – 90
10	91 – 100

### Results and Discussion

The data on disease incidence (%) and yield [Tables-3, 4, 5 and 6] during both the seasons indicated that the Bupirimate 25% EC fungicide treated plants showed effective control of the disease. The fungicide Bupirimate 25% EC @ 4 ml/L water and @ 6 ml/L water was found on par and resulted in lower incidence of powdery

mildew and higher yield when compared to Carbendazim 50% WP @ 1g/plant in 2 L and lower dosage of testing chemical Bupirimate 25% EC 2 ml/L water. Untreated control recorded highest disease incidence. The phytotoxicity observations recorded are summarized in [Table-7 and 8]. The observations recorded during both seasons after 1, 3, 5, 7 and 10 days of each application clearly indicated that there was no phytotoxicity symptoms like yellowing, wilting, epinasty, hyponasty, necrosis and vein clearing in all the treatments. Thus Bupirimate 25% EC @ 2 ml/L water, 4 ml/L water, 6 ml/L water and 8ml/L water was non phytotoxic to rose plants both in 1<sup>st</sup> year as well in the 2<sup>nd</sup>. Carbendazim 50 % WP @ 1g/L was also not having any phytotoxic effect on rose plant in both the seasons. There was a lower disease incidence and higher yield with the increase in the concentration of Bupirimate 25% EC. The use of Bupirimate has also been recorded earlier [7] in Israel and [8] in Spain.

It is evident from the present investigation that Bupirimate 25% EC was effective against Powdery mildew in rose @ 4 ml/L water and 6 ml/L water. The highest rose yield obtained from the treatment Bupirimate 25% EC @ 6 ml/L water was at par with Bupirimate 25% EC @ 4 ml/L water of product formulation. Application of Bupirimate 25% EC up to 8 ml/L water dose did not show any phytotoxic symptoms in rose. Therefore, use of Bupirimate 25% EC is safe to rose plants. The use of Bupirimate 25% EC @ 4 ml/L water is suggested to control powdery mildew disease on rose plants.

The Bupirimate which is chemically defined as 5 Butyl-2-ethylamino-6-methylpyrimidin-4yl-dimethylsulfamate that belongs to the group Pyrimidinol (2-Aminopyrimidine) can be effectively used as alternate chemical along with strobilurins and triazoles. However, the dose of formulation used is at higher rate i.e. 4 to 6 ml per litre. Bupirimate belongs to FRAC 8 to which dimethirimol and ethirimol also belong to. It has both systemic as well as trans-laminar movement inside the plant.

**Table-3** Incidence of powdery mildew on rose plants treated with various fungicides during 1<sup>st</sup> year

Treatment	Dose (Formulation)	Disease incidence (%)			
		Before spray	7 days after 1 <sup>st</sup> spray	7 days after 2 <sup>nd</sup> spray	7 days after 3 <sup>rd</sup> spray
Bupirimate 25% EC	2 ml/L water	0.56(4.27)	8.33(16.78)	10.00 (18.43)	11.11(19.47)
Bupirimate 25% EC	4 ml/L water	1.67(7.42)	3.33(10.52)	3.89(11.37)	5.00(12.92)
Bupirimate 25% EC	6 ml/L water	1.11(6.05)	2.22(8.57)	2.78(9.59)	4.44(12.17)
Carbendazim 50% WP	1 g/ plant in 2 L water	1.11(6.05)	5.56(13.63)	8.33(16.78)	9.44(17.90)
Control	-	1.67(7.42)	28.33(32.16)	36.67(37.27)	38.33(38.25)
CD @ 5%		NS	2.88	4.73	4.77

The figures in the parenthesis are arc sin transformed values.

**Table-4** Incidence of powdery mildew on rose plants treated with various fungicides during 2<sup>nd</sup> year.

Treatment	Dose (Formulation)	Disease incidence (%)			
		Before spray	7 days after 1 <sup>st</sup> spray	7 days after 2 <sup>nd</sup> spray	7 days after 3 <sup>rd</sup> spray
Bupirimate 25%EC	2 ml/L water	3.33(10.52)	9.44(17.90)	11.11(19.47)	12.22(20.46)
Bupirimate 25%EC	4 ml/L water	2.78(9.59)	4.44(12.17)	5.00(12.92)	6.11(14.31)
Bupirimate 25%EC	6 ml/L water	1.67(7.42)	3.33(10.52)	3.89(11.37)	5.56(13.63)
Carbendazim 50% WP	1 g/ plant in 2 L water	2.22(8.57)	7.78 (16.20)	10.00(18.43)	12.11 (20.36)
Control		2.78(9.59)	29.44(32.86)	37.78(37.93)	39.44(38.91)
CD @ 5%		NS	3.79	5.33	5.35

The figures in the parenthesis are arc sin transformed values

**Table-5** Effect of Bupirimate 25% EC on flower yield of rose variety 'First Red'

Treatment	Dose (Formulation)	Total flower Yield Q/ha	
		2013	2014
Bupirimate 25% EC	2 ml/L water	14.00	14.10
Bupirimate 25% EC	4 ml/L water	17.75	17.15
Bupirimate 25% EC	6 ml/L water	18.00	17.90
Carbendazim 50% WP	1 g/ plant in 2 L water	14.50	14.97
Control	-	10.25	09.92
CD @ 5%		1.65	1.53

### Conclusion

From the present study, it was concluded that Bupirimate 25% EC was effective against Powdery mildew in rose @ 4 ml/L water and 6 ml/L water. At this dose of chemical, the disease incidence was lowest and the yield obtained was highest.

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### Author contributions

Mahesh Kumar Kumawat - data collection, data analysis and interpretation, drafting the article, and acted as corresponding author  
 Neethu K. Chandran - data collection, critical revision of the article,  
 S. Sriram - critical revision of the article, final approval of the version to be published

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**Ethical approval:** This article does not contain any studies with human participants or animals performed by any of the authors.

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