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Short Communication

Efficacy of bioagents and fungicide in controlling of ber powdery mildew

Shashi Kant Goyal*, Shailesh Godika, Ram Phool Ghasolia, and Jitendra Sharma

Department of Plant Pathology, S.K.N. College of Agriculture (SKNAU) Jobner -303329 Jaipur, Rajasthan (India)
*Corresponding author's Email: shashikant69@gmail.com
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Ber (*Ziziphus mauritiana* Lank.) is an ancient and poor man fruit crop, one of the most important underutilized fruit owing to its hardy nature and grown in semi-arid and arid regions of India and other few countries. Powdery mildew of *ber* incited by *Oidium erysiphoides* f. sp *ziziphi* is a serious problem in *ber* growing areas in India (Kapoor et al 1975 ; Gupta et al 1978 ; Yadav et al 1981) causing great loss in productivity and quality of fruits (Prakash, 1984 ; Rawal, 1988). The disease was first reported from Allahabad (Mitter and tandon 1930). Kumar et al (1978) noted the occurrence of powdery mildew of *ber* (*Ziziphi* spp.) in Indian arid zones. The fungus produces whitish powdery mass of spores on all the aerial plant parts resulting in pre-mature drop of flower buds and fruits (Rawal,1988). Infected fruits show discolouration, cracking and become mummified and foil to develop. Owing to expansion of ber orchards, working out of management strategies are also equally important to sustain the yield and quality of ber fruits. The bio control method against powdery mildew is very limited in most of the crop plants. Therefore, an attempt was made for management of the disease through bioagents along with effective fungicide.

A field experiment was conducted on susceptible local *ber* cultivar'Kali' at farmer's orchard at Udaipuria village (Chomu) in statistically randomized block design in the six consecutive years (2006-2007 to 2011-2012). Each treatment was replicated thrice by keeping single tree per replication. An equal ntumber of unsprayed plants were kept as control. The native isolates of *Trichoderma* and *Pseudomonas* were provided by CIAH, Bikaner to compare their efficacy along with karathane fungicide which is found most effective against the pathogen (Gupta et al 1977; Reddy et al 1990; Yadav and Singh 1985). Under the study different bioagents alone and alongwith effective fungicide (T_1= 1% *P. fluorescens* (CIAH-196)+ 0.05% karathane, T_2 = 1% *P. fluorescens* (NR)+ 0.05% karathane. T_3= 1%*Trichoderma* (CIAH-240))+ 0.05% karathane. T_4= 1%*Trichoderma* (NR)+ 0.05% karathane, T_5= 0.05% karathane and T_6= 0.1 % karathane were tested against ber powdery mildew . Three foliar sprays were given at 15 days interval and disease intensity was recorded after 20 days of last spray. First spray was given just to start initiation of the disease symptoms. The data on the development of powdery mildew on ber fruits were recorded on the randomly four marked fruiting twigs at each directiou per plant. Diseased fruits were graded into six categories of disease incidence i.e. 0 = healthy, 1 = 1-10, 2 = 10.1-25, 3 = 25.1-50, 4 = 50.1-75, 5 = > 75 % fruit area covered with powdery mildew.

The per cent disease index (PDI) and per cent disease control (PDC) were calculated according to the following formula:

$$PDI = \frac{\text{Sum of all numerical ratings}}{\text{Total number of fruits examined X 5}} X \ 100$$

$$PDC = \frac{\text{PDI in control -- PDI in treatment}}{\text{PDI in central}} X \ 100$$

Fruit yield of the tree was also recorded in each treatment at the time of fruits harvesting.

Six years pooled data presented in Table 1 revealed that all the treatments tested against ber powdery mildew were reduced the disease and intensity and also increased the fruit yield significantly in comparison to control. Karathane (0.1%) reduced the disease intensity significantly in comparison to control and other treatments. Minimum disease intensity (13.74%) was obtained in karathane (0.1%) followed by 1% *P. fluorescens* (NR) + 0.05% karathane (19.94 PDI). Whereas, in control PDI was 55.14. Maximum per cent disease control (75.06) was obtained in karathane (0.1%) followed by 1% *P. fluorescens* (NR) + 0.05% karathane (63.80) and also increased fruit yield significantly in comparison to other treatments. To circumvent pollution hazard due to injudicious use of agrochemicals and also to avoid development of resistance in pathogenic fungi to commonly used fungicides, use of biocontrol agents for the management of plant diseases has been tremendously increased in recent years. Keeping in view the bioagents were applied against the ber powdery mildew. In many cases, hyperparasites like *Ampelomyces quisqualis* has been exploited in other horticultural crops. Hofstein et al. (1996) have developed new product known as 'AQ10' for the management of powdery mildews with suggestions that it could be included as preventive control agent. The native isolates of *Trichoderma* (CIAH-240) and *Pseudomonas fluorescens* (CIAH-196) along with 50 per cent less concentration than recommended dose of fungicide (karathane) were found effective against the ber powdery mildew (Nallathambi et al. 2007). During the

present studies for the management of this disease, karathane 0.1 % was found most effective. These findings are in close agreement with results of Jain and Jat 1988; Reddy et al 1990; and Reddy et al 1996) who reported that karathane was most effective fungicide against the ber powdery mildew. Thind et al (2007) also reported thet Bayleton and karathane was found most effective in controlling the ber powdery mildew. In the present investigation economic of different treatments applied against the powdery mildew disease was also find out and the results revealed (Table 2) that maximum cost: benefit ratio was found with karathane (0.1 %). Three foliar sprays of karathane (0.1 %) at 15 days interval is recommended for control of ber powdery mildew. The prophylactic spray must be given just to start initiation of disease symptoms.

Table 1: Effect of different bioagents and fungicide against ber powdery mildew (Pooled 2006-2011)

S.N.	Treatments	Percent disease index (PDI)		Percent disease control (PDC)	Fruit yield (Kg/tree)
1	1% *P. fluorescens*(CIAH-196)+ 0.05% karathane	30.13	(33.27)	45.33	68.73
2	1% *P. fluorescens*(NR)+ 0.05% karathane	19.94	(26.48)	63.80	76.96
3	1%*Trichoderma*(CIAH-240))+ 0.05% karathane	23.16	(28.76)	57.96	72.86
4	1%*Trichoderma*(NR)+ 0.05% karathane	26.40	(30.92)	52.07	70.56
5	0.05% karathane	30.16	(33.31)	45.26	71.36
6	0.1 % karathane	13.74	(21.72)	75.06	80.40
8	Unsprayed check	55.14	(47.95)	-	49.86
	S.Em. $\pm$	(0.266)			0.529
	C.D. at 5%	(0.8069)			1.606

Figures in parentheses are angular transformed values

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