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Screening of Ber cultivars / germplasm against *Oidium erysiphoides* f. sp. *ziziphi*, causing powdery mildew

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Abstract
Powdery mildew incited by *Oidium erysiphoides* f. sp. *ziziphi*, Yan and Wang is the most important disease that causes maximum reduction in yield and quality of ber (*Ziziphus mauritiana* Lamk.) fruits grown under semi-arid and arid regions of India. Developing a varietal resistance to disease provides an early, cheaper, stable and effective means of disease control. In the present investigation, 21cultivars / germplasm were tested for resistant against *Oidium erysiphoides* f. sp. *ziziphi.* Out of theses, two cultivars / germplasm namely Darakhi-2, Nazuk showed 2.60 and 4.67 per cent disease intensity, respectively and categorized as resistant whereas Faliso Alwari, Jogia, Kaithali, Katha, Kishmis, Mehroon, Mundia, Safarchandi, Tabestaso and ZG-3 showed moderately susceptible reaction and Chhuhara, Chhuhara-1, Chonchal, Gola, Illaichi, Kathaphal, Seb, Thornless and Umran showed susceptible reaction.

Keywords: Ber, *Ziziphus mauritiana,* powdery mildew, *Oidium erysiphoides* f. sp. *ziziphi,* cultivars/germplasm

Introduction
Indian jujube or ber (*Ziziphus mauritiana* Lamk.) is one of the most common fruit, indigenous to an area joined from India to China. The genus *Ziziphus* has been derived from '*Zizaif*' which is the Arabic name of the fruit. The ber belongs to the family *Rhamnaceae* which has about 50 genera and more than 600 species (Pareek, 1983) [7]. In India, ber is being cultivated on an area of about 4,845 hectares with production of 66,296 metric tonnes and productivity of 13.68 metric tonnes (Anonymous, 2014) [1]. Ber is hardy crop which grown in arid conditions of Rajasthan, characterized by sandy soils, scanty rainfall (400-600mm), thermal oscillations (5-35 ^{0}C) and low relative humidity. Ber fruit contains 39-166 mg of ascorbic acid (vitamin C, per 100 g of pulp) which is higher than citrus and apple.
Ber is attacked by many of the diseases caused by fungi and other pathogenic agents. Among these, powdery mildew is one of the most important, wide spread and easily recognized disease. In India, this was first reported by Mitter and Tendon (1930) [6] from Allahabad. Powdery mildew caused by *Oidium erysiphoides* f. sp. *ziziphi,* Yan and Wang (*Microsphaera alphitoides* f. sp. *ziziphi* Griffon and Maublanc) is a major disease of ber / jujube in India (Jamadar *et al*. 2009) [2]. Jamadar and Desai (1996) [3] have also been recorded 17-71 per cent disease index at fruiting stage of ber due to powdery mildew *(Oidium* sp.) in Bijapur, India. Control of diseases through chemicals is quite expensive, need extra labour and also not eco-friendly. Developing a varietal resistance to disease provides an early, cheaper, stable and effective means of disease control. Therefore, attempts were made to screen out resistance varieties/germplasm against powdery mildew.

Materials and Methods
Ten year old 29 cultivars/germplasm of ber grown at Asalpur Farm, Jobner (Jaipur) were observed for disease intensity at the peak of disease (in the last week of Dec., 2016) under RBD with three replications (one tree per replication). Two hundred fruits (50 from each direction) of a tree were picked up randomly in the last week of Dec., 2016 and per cent disease intensity was calculated as per 0-5 disease rating scale of McKinney (1923) [5].

$$\text{Percent disease intensity (PDI)} = \frac{\text{Sum of individual ratings}}{\text{Total no. of observations x Maximum disease rating}} \times 100$$

Disease rating scale for assessing host reaction against powdery mildew of ber is as follows,

Grade/Numerical scale	Description
0	0 % - No infection on fruit
1	1-10% - Fruit area covered with pathogen
2	11-25% - Fruit area covered with pathogen
3	26-50% - Fruit area covered with pathogen
4	51-75% - Fruit area covered with pathogen
5	76-100% - Fruit area covered with pathogen

Categorization of ber varieties on the basis of per cent disease intensity are as follows:

PDI	Host reaction
0	Immune
1-5	Resistant
6-20	Moderately susceptible
21-50	Susceptible
51-100	Highly susceptible

Result and Discussion

The reaction of 21 varieties / germplasm was observed (Table 1) against powdery mildew of ber according to disease rating scale of McKinney (1923) [5]. Darakhi-2 and Nazuk cultivars/germplasm were categorized as resistant as these showed 2.60 and 4.67 per cent disease intensity, respectively. Ten cultivars/germplasm viz. Katha Kishmis, Tabestaso, Safarchandi, Jogia, Mehroon, ZG-3, Mundia, Faliso Alwari and Kaithali were showed 7.52, 8.13, 8.93, 9.20, 11.93, 12.33, 12.91, 17.27, 17.60 and 18.80 per cent disease intensity, respectively and categorized as moderately susceptible cultivars/ germplasm whereas, nine cultivars/ germplasm viz. Illaichi, Chhuhara, Chhuhara-1, Kathaphal, Seb, Chonchal, Umran, Gola and Thornless were showed higher per cent disease intensity (22.18 - 37.5%) and categorized as susceptible cultivars/germplasm. Our observations confirm the findings of Kapoor *et al.* (1975) [4], Jamader and Desai (1996) [3], Thind and Kaur (1997) [9] and Pradeep and Jambhale (2001) [8]. According to Kapoor *et al*. (1975) [4] Umran and Kaithali showed moderate to severe infection. Thind and Kaur (1997) [9] have reported that Chhuhara, Sanaur-2 and Umran are resistant to powdery mildew, caused by *Oidium erysiphoides* f. sp. *ziziphi*.

Table 1: Disease reaction of different cultivars/germplasm of ber against powdery mildew (*Oidium erysiphoides* f. sp. *ziziphi*)

S. No.	Cultivars/germplasm	Per cent disease intensity *	Host reaction
1.	Darakhi-2	2.60	R
2.	Nazuk	4.67	R
3.	Faliso Alwari	17.60	MS
4.	Jogia	11.93	MS
5.	Kaithali	18.80	MS
6.	Katha	7.52	MS
7.	Kishmis	8.13	MS
8.	Mehroon	12.33	MS
9.	Mundia	17.27	MS
10.	Safarchandi	9.20	MS
11.	Tabestaso	8.93	MS
12.	ZG-3	12.91	MS
13.	Chhuhara	27.80	S
14.	Chhuhara-1	23.80	S
15.	Chonchal	30.40	S
16.	Gola	32.73	S
17.	Illaichi	22.18	S
18.	Kathaphal	29.13	S
19.	Seb	29.40	S
20.	Thornless	37.50	S
21.	Umran	30.85	S
	SEm±	1.42	-
	CD (p= 0.05)	4.38	-

* Average of three replications, I= Immune (PDI=0), R = Resistant (PDI=1-5), MS= Moderately susceptible (PDI=6-20), S= Susceptible (PDI= 21-50), HS= Highly Susceptible (PDI= 51-100).

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