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Short Communication

Effect of Rainfall on Incidence of Powdery Mildew in *Ber*

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Powdery mildew in ber (*Ziziphus mauritiana*), caused by *Oidium erysiphoides* f. *ziziphi*, is an important disease (Kapur *et al.*, 1975; Gupta *et al.*, 1978; Yadav *et al.*, 1981). Mildew infection starts around October and develops rapidly, causing premature drop of flower buds, flowers and fruits. In severe cases, the fruit surface becomes cocky, cracked and cankerous, which affect the fruit quality adversely (Pareek, 1983; Vidya, 1984). In present investigation, effect of rainfall on build up of the disease was studied at National Research Centre for Agroforestry, Jhansi (25° 27′ N, 78° 35′E). Observations on disease severity were recorded on ten plants of variety Banarasi Karaka after 40, 54, 68, 82, 96 and 110 days of flower initiation from 1996 to 1998. The flowering started in aforesaid ber plants during second week of September. The incidence of disease was recorded by using 5 ratings for the disease as followed by McKinney (1923), and disease index was calculated.

The extent of damage caused by disease was also recorded in terms of percent cankerous cracked fruit surface area. Weather data on rainfall, maximum and minimum temperature, RH-I (relative humidity at 8 a.m.) and RH-II (relative humidity at 2 p.m.) from September to December, was obtained from Indian Grassland and Fodder Research Institute, Jhansi. Fortnightly averages of aforesaid parameters were calculated and are presented in Table 1. The graph has been prepared using SYSTAT (Wilkinson, 1996).

The data recorded on disease index clearly indicated that the severity of powdery mildew of ber was maximum during 1997, followed by 1996 and 1998 (Fig. 1). The extent of damage was 44.3, 67.8 and 5.8% in terms of cankerous/cracked fruit surface area during 1996, 1997 and 1998, respectively. The rainfall received during the last trimester of the year was maximum in 1997 (492.7 mm), followed by 1996 (209.4 mm) and 1998 (81.2 mm). Rains were received in all four months during 1997, in September and October during 1996 and in September during 1998 (Table 1). Amount of rainfall and its distribution showed considerable effect on temperature and humidity and the observed differences in severity of the disease can be attributed to it. The disease has been reported to develop optimally between 15 and 25°C, whereas temperature of 10 and 30°C were found nonconducive. Relative humidity requirement for the disease is in a wide range and its development has been reported to be normal at or above 32% (Parkash and Jhooty, 1987). Following factors might

Table 1. Fortnightly average of some weather parameters during last trimester of 1996, 1997 and 1998 at Jhansi

Year	September		October		November		December	
	F_1*	F_2	F_1	F_2	F_1	F_2	F_1	F_2
Rainfall (mm)								
1996	103.7	0.0	102.2	3.5	0.0	0.0	0.0	0.0
1997	196.0	0.0	15.4	92.9	0.0	29.1	159.3	0.0
1998	32.6	48.6	0.0	0.0	0.0	0.0	0.0	0.0
Maximum temperature (°C)								
1996	31.9	34.4	32.0	29.6	31.1	27.5	24.0	24.6
1997	30.8	34.7	32.3	28.7	29.1	24.0	20.9	16.5
1998	33.6	34.0	34.3	33.0	30.3	28.5	27.8	24.1
Minimum temperature (°C)								
1996	24.0	22.8	19.9	16.3	11.8	7.9	4.1	4.2
1997	23.8	23.6	15.5	13.7	13.8	13.9	11.9	8.0
1998	25.1	24.8	22.5	17.8	14.9	10.9	7.2	6.2
RH-I (%)								
1996	96.6	89.9	93.3	90.8	91.3	95.6	94.7	96.2
1997	94.9	87.9	92.5	95.3	97.2	97.1	96.7	96.1
1998	90.1	91.3	89.8	85.9	87.3	86.2	86.8	94.1
RH-II (%)								
1996	74.6	48.2	49.7	43.1	24.4	28.1	28.7	32.4
1997	68.1	59.7	53.8	54.4	45.3	64.3	72.9	77.4
1998	61.9	58.5	49.5	49.9	53.7	29.7	27.9	41.3

*F_1 - First fortnight; F_2 - Second fortnight.

have played a crucial role in the disease development:

— Rains in October brought the maximum temperature below 30°C (upper cardinal temperature), which started the disease earlier (Table 1).

— Rainfall in November and December kept the minimum temperature above 10°C (lower cardinal temperature) and RH-II above 32% (lower limit of RH for disease development). This lengthened the favorable period for the disease development (Table 1).

The length of favorable period for the disease development was estimated on the basis of reports of Parkash and Jhooty (1987) and data given in Table 1, i.e., when maximum temperature was below 30°C, minimum temperature was above 10°C and relative humidity (RH-I & RH-II) was above 32% (Table 2). The period was maximum during 1997 (60 days), followed by 1996 (15 days) and 1998 (0 day). The trend is in accordance with the disease data (Fig. 1). It indicates that the amount of rainfall received during the period of disease development (October to December)

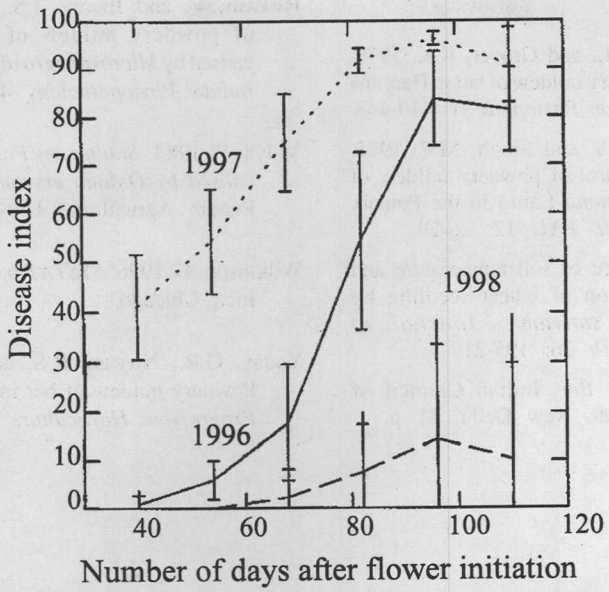

Fig. 1. Build up of powdery mildew of ber in 1996, 1997 and 1998.

influenced temperature and RH in such a way that the composite effect of all the three factors led to considerable increase in disease severity.

The disease management strategies should include a resistant variety, particularly in areas where winter rains are common. Pareek (1983) has reported that Safeda, Safeda Selected, Nazuk, Galory, Sanaur-2, ZG-2, ZG-3, ZG-4, and Chinese are resistant to the disease.

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Table 2. Estimation of length of favorable period for disease development based on Parkash and Jhooty (1987) and data given in Table 1

Condition	Length of period during		
	1996	1997	1998
Max. temp. below 30°C and min. temp. above 10°C	F_2* October to F_1 November	F_2 October to F_1 December	F_2 November
RH-I and RH-II above 32%	F_1 September to F_2 October	F_1 September to F_2 December	F_1 September to F_1 November, F_2 December
Max. temp. below 30°C, min. temp. above 10°C and RH-I and RH-II above 32%	F_2 October (15 days)	F_2 October to F_1 December (60 days)	Nil (0 day)

*F_1 - First fortnight; F_2 - Second fortnight.

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