

Evaluation of pearl millet germplasm lines against downy mildew incited by *Sclerospora graminicola* in western Rajasthan

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Introduction

Downy mildew caused by *Sclerospora graminicola* is a major concern for all pearl millet (*Pennisetum glaucum*) growing areas in India, as it is one of the destructive and widespread diseases. Initial symptoms of the disease are leaf chlorosis and stunting, and later 'green ear' develops due to transformation of floral parts into leafy structures. Under high humidity, the infected leaf areas support massive sporulation giving them a downy appearance. It causes severe yield losses under favorable conditions. Disease management using resistant cultivars is the most feasible way in pearl millet production. Attempts have been made in the past to identify sources of resistance to downy mildew in India (Singh et al. 1997). Based on resistant sources, several resistant hybrids and varieties were released for general cultivation in India (Khairwal et al. 2004). However, identification of new sources of resistance is required to find resistance against evolving virulences especially in western Rajasthan where pearl

millet is widely cultivated. In our investigation, an attempt was made to identify germplasm lines and local landraces resistant to the disease under artificial epiphytotic conditions.

Materials and methods

One hundred and forty-seven germplasm lines were planted during rainy season of 2005 and 2006 at Mandor, Jodhpur, Rajasthan in a downy mildew sick plot using infector row system (Williams et al. 1981). The infector rows (mixture of 7042 S and local susceptible material) were planted three weeks prior to the test entries for uniform spread of sporangial inoculum to test entries. Highly susceptible line 7042 S was also planted after every five test entries to know the spread of disease in the plot. Each line was sown in single row (5 m) with spacing of 50 cm × 10 cm. In another set of experiment, 21 local landraces collected from different parts of Rajasthan

Table 1. Reaction of pearl millet germplasm lines to downy mildew.

Disease incidence (%)	Reaction ¹	Genotypes
0–5	HR	IP 9, IP 29, IP 55, IP 87, IP 104, IP 172, IP 253, IP 262, IP 283, IP 336, IP 346, IP 352, IP 364, IP 365, IP 396, IP 486, IP 498, IP 505, IP 517, IP 545, IP 556, IP 558, IP 575, IP 682, IP 718
>5–10	R	IP 2, IP 39, IP 97, IP 103, IP 170, IP 181, IP 215, IP 260, IP 264, IP 266, IP 268, IP 286, IP 289, IP 318, IP 327, IP 355, IP 368, IP 374, IP 395, IP 428, IP 429, IP 478, IP 485, IP 487, IP 541, IP 549, IP 563, IP 572, IP 590, IP 700, IP 709, IP 758
>10–25	S	IP 10, IP 26, IP 42, IP 50, IP 61, IP 96, IP 113, IP 137, IP 187, IP 197, IP 212, IP 225, IP 226, IP 228, IP 236, IP 263, IP 265, IP 272, IP 275, IP 276, IP 284, IP 285, IP 319, IP 323, IP 334, IP 331, IP 343, IP 345, IP 349, IP 353, IP 363, IP 376, IP 379, IP 389, IP 399, IP 427, IP 475, IP 476, IP 477, IP 489, IP 509, IP 551, IP 553, IP 561, IP 564, IP 565, IP 569, IP 647, IP 737, IP 743, IP 753, IP 790
>25	HS	IP 33, IP 38, IP 57, IP 79, IP 128, IP 141, IP 231, IP 278, IP 281, IP 290, IP 294, IP 300, IP 309, IP 313, IP 329, IP 339, IP 344, IP 366, IP 371, IP 373, IP 378, IP 388, IP 410, IP 416, IP 422, IP 479, IP 480, IP 482, IP 488, IP 493, IP 510, IP 515, IP 544, IP 550, IP 574, IP 651, IP 799, IP 973

1. HR = Highly resistant; R = Resistant; S = Susceptible; HS = Highly susceptible.

Table 2. Evaluation of local landraces of Rajasthan for downy mildew resistance.

Landrace	Downy mildew incidence (%)	Reaction
Ardi-Beniya Ka Bas	3.1	HR
Dhodsar local (Sunda ram)	4.5	HR
Desi Bajri-Chomu	4.3	HR
Desi Bajri-Osian	6.4	R
Chadi local	7.0	R
Bikaneri Bajri-Raisar	9.4	R
Bikaneri Desi-Jodhasar	10.0	R
Jakharana (Ex-situ)	8.5	R
Ardi-Dungarsi Ka Bas	5.3	R
Mandeta local	6.8	R
Dhodsar local (original)	6.7	R
Desi-Karnoo	19.2	S
Chadi (NB)	13.6	S
Chadi local (Ex-situ)	12.8	S
Desi-Panchu	12.4	S
Desan Bajri (SPS)	14.9	S
Desan Bajri-Panchu	11.7	S
Sulkanya local (Ex-situ)	12.0	S
Desan Bajri	23.2	S
Desi-Birsalu	37.6	HS
Desi-Biraniya	36.7	HS
7042S (susceptible check)	94.5	HS
SEM±	2.098	–
CD (0.05)	6.172	–

were evaluated in a sick plot using the field screening technique described above. Sprinkler irrigation was provided as and when needed to maintain high relative humidity and favorable conditions for disease development. The disease was scored at two growth stages, 30 and 60 days after planting (DAP) by counting the total number of plants and number of infected plants and percent disease incidence was calculated. Based on two years data at 60 DAP the entries were classified in different categories as highly resistant – 0–5% incidence, resistant – >5–10% incidence, susceptible – >10–25% incidence and highly susceptible – >25% incidence.

Results and discussion

The mean downy mildew incidence on 7042 S (indicator row) was more than 90% after 30 and 60 DAP, which indicated the uniform and good spread of the disease in

the sick plot. Based on mean incidence of two years, the reaction of germplasm lines are depicted in Table 1.

Significant variation in disease incidence of downy mildew was observed on lines that ranged from 0 to 96%. The data indicated that more than 60% genotypes were susceptible or highly susceptible. Of the 147 pearl millet lines screened, 25 were highly resistant, 32 resistant, 52 susceptible and 38 highly susceptible to downy mildew (Table 1). Among 25 highly resistant lines of pearl millet, ten lines (IP 9, IP 55, IP 104, IP 253, IP 262, IP 336, IP 346, IP 498, IP 545 and IP 558) were completely free from downy mildew infection at both the growing stages (30 and 60 DAP) in both the years of testing (2005 and 2006).

Among the 21 landraces evaluated, none showed complete resistance to the disease. However, three landraces, Ardi-Beniya Ka Bas, Dhodsar local (Sunda Ram) and Desi Bajri-Chomu, were highly resistant; and eight landraces, viz, Desi Bajri-Osian, Chadi local, Bikaneri Bajri-Raisar, Bikaneri Desi-Jodhasar, Jakharana (Ex situ), Ardi-Dungarsi Ka Bas, Mandeta local and Dhodsar local (original) were resistant to the disease. Remaining eight landraces were susceptible and two were highly susceptible to the disease (Table 2).

The highly resistant and resistant germplasm lines and landraces identified in this study can be utilized in breeding program to develop downy mildew resistant hybrids for western Rajasthan and for other pearl millet growing areas after testing against different pathotypes of *S. graminicola*.

References

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