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# Evaluation of pearl millet R-line under field condition to identify resistance sources of foliar blast pathogen

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**Abstract**
Pearl millet (*Pennisetum glaucum*), an important staple food crop in the semiarid tropics of the world, is infected by a number of diseases. Important among these are downy mildew (*Sclerospora graminicola*), blast (*Pyricularia grisea*), rust (*Puccinia substriata* var. indica). Ergot (*Claviceps fusiformis*) and smut (*Moesiziomyces penicillariae*) that individually or in combination cause substantial yield and quality losses. Effective and economic control of these diseases can be achieved by growing disease resistant varieties and hybrids. One hundred thirty potential R-lines were evaluated for blast resistance in the field. One hundreds eighteen lines identified as blast resistant (score ≤3.0 on 1–9 scale). These resistant lines would be useful in breeding blast resistant pearl millet hybrids.

**Keywords:** pearl millet R-line, foliar blast pathogen

## Introduction
Pearl millet (*Pennisetum glaucum* (L.) R. Br.), belongs to family Poaceae, is popularly known as bajra is an important cereal crop cultivated on an area of 30 million ha in arid and semi-arid regions of the world, especially in Asia and African countries (Yadav and Rai, 2013) [10]. The crop is grown mainly by marginal farmers, due its high nutritional value, tolerant to drought and excellent storage qualities (Bidinger *et al*., 1987; Rai *et al*., 2008; Kumar *et al* 2018) [2, 4, 6]. In India, pearl millet is cultivated over an area of 9 million ha with the annual production of 9.5 million tonnes, mainly in the states of Rajasthan, Gujarat, Maharashtra, Punjab, Uttar Pradesh, Tamil Nadu, Karnataka and Madhya Pradesh (Yadav and Rai, 2013; Yadav *et al*., 2012) [10, 11].
Pearl millet is an important cereal crop grown for grain and fodder in arid and semi-arid regions of India. *Pyricularia grisea* (teleomorph: *Magnaporthe grisea*) is known to cause devastating foliar blast disease leading to reduction in grain and fodder yields in pearl millet. Internal transcribed spacer sequencing of ribosomal DNA revealed that the foliar blast of pearl millet in western arid Rajasthan, India, is caused by *Pyricularia pennisetigena* (Singh *et al*.; 2020) [8]. Blast disease of negligible importance in past years, has now considered as top priority constraints to pearl millet production in India (Lukose *et al*., 2007) [5]. The disease affects crop at all the growth stages, symptoms appear as grayish, water-soaked foliar lesions that enlarge and become necrotic, resulting in extensive chlorosis and premature drying of leaves, leads to substantial yield loss of both grain and forage (Wilson and Gates, 1993; Timper *et al.* 2002) [7, 9].
Perl millet cultivars being cultivated in the major pearl millet growing states of India were found to exhibit various levels of disease severity on hybrids and local cultivars (AICPMIP, 2011–12). The disease becomes more severe in the temperature of 25-28 °C coupled with high relative humidity (Kato, 2001) [3]. Even though, use of chemical fungicides can control the disease, their use is not favoured by the farmers due to cost, and associated environmental and health issues. Hence, growing cultivars with durable resistance is the most economical and viable disease management strategy to control the disease. However, resistance in the commercial hybrids being grown in India is not available as no efforts were made in the past to breed for blast resistance.
In the present study we conducted the evaluation of 130 pearl millet accessions to identify new pearl millet blast resistance sources. So as to use the resistant cultivars as donors in pearl millet breeding programs and as starting material for the isolation of novel blast resistance genes and allelic variants of major pearl blast resistance genes.

## Materials and Methods

The field experiment was conducted in a randomized complete block design with two replications, one row of 2 m length/entry in each replication. Systematic susceptible checks (ICMB 95222 and ICMB 95444) were planted on every 5th row alternately to increase disease pressure. Plants were thinned to 20 plants/row 15 days after planting and other agronomic practices were followed as per local practices. Disease severity was recorded at the hard dough stage using a 1–9 progressive scale (Fig. 1) developed at International Rice Research Institute (IRRI), Philippines for blast on the 5 randomly selected and tagged plants of each line for pearl millet blast (1 = no lesion to small brown specks of pinhead size; 2 = larger brown specks; 3 = small, roundish to slightly elongated, necrotic gray spots, about 1–2 mm in diameter with a brown margin; 4 = typical blast lesions, elliptical, 1–2 cm long, usually confined to the area between main veins, covering <2% of the leaf area; 5 = typical blast lesions covering <10% of the leaf area; 6 = typical blast lesions covering 10–25% of the leaf area; 7 = typical blast lesions covering 26–50% of the leaf area; 8 = typical blast lesions covering 51–75% of the leaf area and many leaves dead; 9 = all leaves dead). The experiment was conducted under natural condition in the field of AICRP on pearl millet, station Mandor, Jodhpur during *kharif* 2019-20 (Fig. 2 & 3).

$$\text{Percent disease incidence (\%)} = \frac{\text{Sum of individual disease rating}}{\text{Number of leaves assessed X Max. Grad}} \text{ X100}$$


**Fig 1:** Foliar blast severity rating scale (1-9)

## Result

In the 130 designated R-lines, blast scores ranged from 1.0 to 9.0 on a 1–9 scale compared to a score of 7.0 to 9.0 in the susceptible checks. One hundreds eighteen lines (MIR 503, MIR 513, MIR 514, MIR 516, MIR 517, MIR 519-2-1, MIR 520, MIR 522-1, MIR 523, MIR 524, MIR 525, MIR 548-1, MIR 549-1, MIR 606-1, MIR 611, MIR 612, MIR 701-1, MIR 705-1, MIR 710, MIR 712, MIR 714, MIR 906-2, MIR 915-1, MIR 916-2, MIR 920-1, MIR 1101, MIR 1106, MIR 1107, MIR 1109, MIR 1112, MIR 1114-2, MIR 1116, MIR 1117, MIR 1252, MIR 1253, MIR 1254, MIR 1255, MIR 1256, MIR 1259, MIR 1261, MIR 1262-1, MIR 1263, MIR 1264, MIR 1265, MIR 1266, MIR 1267, MIR 1268, MIR 1269, MIR 1270, MIR 1271, MIR 1272, MIR 1273, MIR 1274, MIR 1278, MIR 1354, MIR 1356, MIR 1357, MIR 1359, MIR 1361, MIR 1362, MIR 1363, MIR 1367, MIR 1368, MIR 1369, MIR 1371, MIR 1372, MIR 1374, MIR 1403, MIR 1404, MIR 1405, MIR 1406, MIR 1407, MIR 1408, MIR 1409, MIR 1410, MIR 1411, MIR 1412, MIR 1601, MIR 1602, MIR 1604, MIR 1702, MIR 1703, MIR 1704, MIR 1705, MIR 1706, MIR 1707, MIR 1708, MIR 1711, MIR 1713, MIR 1714, MIR 1715, MIR 1716, MIR 1717, MIR 1718, MIR 1719, MIR 1720, MIR 1721, MIR 1722, MIR 1725, MIR 1728, MIR 1729, MIR 1801, MIR 1802, MIR 1803, MIR 1804, MIR 1805, MIR 1806, MIR 1807, MIR 1808, MIR 1809, MIR 1901, MIR 1902, MIR 1903, MIR 1904, MIR 1905, MIR 1906, MIR 2001, MIR 2002) were found resistant (score < 3.0), eight (MIR 504-1-2, MIR 506-2, MIR 507, MIR 542, MIR 901-1, MIR 919-2, MIR 1257, MIR 1373) moderately resistant (score 3.1–5.0), two (MIR 510, MIR 621) susceptible (score 5.1–7.0) and two (MIR 1103, MIR 1113) are highly susceptible (score >7.0) (Table 1).

**Fig 2:** Blast symptoms in field of pearl millet

**Fig 3:** Close-up view of blast-infected pearl millet leaf (Green & Dry)

**Table 1:** Selected R-lines of pearl millet with resistance to blast pathogen

| SN | R lines | Blast severity | SN | R lines | Blast severity |
|---|---|---|---|---|---|
| 1 | MIR 503 | 2 | 66 | MIR 1354 | 3 |
| 2 | MIR 504-1-2 | 4 | 67 | MIR 1356 | 3 |
| 3 | MIR 506-2 | 5 | 68 | MIR 1357 | 3 |
| 4 | MIR 507 | 5 | 69 | MIR 1359 | 2 |
| 5 | MIR 510 | 6 | 70 | MIR 1361 | 2 |
| 6 | MIR 513 | 1 | 71 | MIR 1362 | 2 |
| 7 | MIR 514 | 1 | 72 | MIR 1363 | 2 |
| 8 | MIR 516 | 3 | 73 | MIR 1367 | 3 |
| 9 | MIR 517 | 2 | 74 | MIR 1368 | 1 |
| 10 | MIR 519-2-1 | 3 | 75 | MIR 1369 | 3 |
| 11 | MIR 520 | 3 | 76 | MIR 1371 | 1 |
| 12 | MIR 522-1 | 3 | 77 | MIR 1372 | 3 |
| 13 | MIR 523 | 3 | 78 | MIR 1373 | 4 |
| 14 | MIR 524 | 2 | 79 | MIR 1374 | 2 |
| 15 | MIR 525 | 2 | 80 | MIR 1403 | 3 |
| 16 | MIR 542 | 4 | 81 | MIR 1404 | 2 |
| 17 | MIR 548-1 | 2 | 82 | MIR 1405 | 3 |
| 18 | MIR 549-1 | 3 | 83 | MIR 1406 | 2 |
| 19 | MIR 606-1 | 3 | 84 | MIR 1407 | 2 |
| 20 | MIR 611 | 3 | 85 | MIR 1408 | 1 |
| 21 | MIR 612 | 2 | 86 | MIR 1409 | 2 |
| 22 | MIR 621 | 7 | 87 | MIR 1410 | 2 |
| 23 | MIR 701-1 | 3 | 88 | MIR 1411 | 2 |
| 24 | MIR 705-1 | 1 | 89 | MIR 1412 | 2 |
| 25 | MIR 710 | 2 | 90 | MIR 1601 | 3 |
| 26 | MIR 712 | 3 | 91 | MIR 1602 | 3 |
| 27 | MIR 714 | 3 | 92 | MIR 1604 | 2 |
| 28 | MIR 901-1 | 4 | 93 | MIR 1702 | 3 |
| 29 | MIR 906-2 | 2 | 94 | MIR 1703 | 1 |
| 30 | MIR 915-1 | 3 | 95 | MIR 1704 | 1 |
| 31 | MIR 916-2 | 2 | 96 | MIR 1705 | 1 |
| 32 | MIR 919-2 | 5 | 97 | MIR 1706 | 2 |
| 33 | MIR 920-1 | 2 | 98 | MIR 1707 | 3 |
| 34 | MIR 1101 | 3 | 99 | MIR 1708 | 3 |
| 35 | MIR 1103 | 8 | 100 | MIR 1711 | 3 |
| 36 | MIR 1106 | 3 | 101 | MIR 1713 | 3 |
| 37 | MIR 1107 | 3 | 102 | MIR 1714 | 1 |
| 38 | MIR 1109 | 2 | 103 | MIR 1715 | 1 |
| 39 | MIR 1112 | 2 | 104 | MIR 1716 | 2 |
| 40 | MIR 1113 | 8 | 105 | MIR 1717 | 2 |
| 41 | MIR 1114-2 | 3 | 106 | MIR 1718 | 1 |
| 42 | MIR 1116 | 3 | 107 | MIR 1719 | 1 |
| 43 | MIR 1117 | 1 | 108 | MIR 1720 | 1 |
| 44 | MIR 1252 | 3 | 109 | MIR 1721 | 2 |
| 45 | MIR 1253 | 3 | 110 | MIR 1722 | 2 |
| 46 | MIR 1254 | 1 | 111 | MIR 1725 | 3 |
| 47 | MIR 1255 | 2 | 112 | MIR 1728 | 2 |
| 48 | MIR 1256 | 3 | 113 | MIR 1729 | 2 |
| 49 | MIR 1257 | 4 | 114 | MIR 1801 | 3 |
| 50 | MIR 1259 | 3 | 115 | MIR 1802 | 2 |
| 51 | MIR 1261 | 3 | 116 | MIR 1803 | 3 |
| 52 | MIR 1262-1 | 2 | 117 | MIR 1804 | 3 |
| 53 | MIR 1263 | 3 | 118 | MIR 1805 | 3 |
| 54 | MIR 1264 | 2 | 119 | MIR 1806 | 3 |
| 55 | MIR 1265 | 2 | 120 | MIR 1807 | 1 |
| 56 | MIR 1266 | 3 | 121 | MIR 1808 | 2 |
| 57 | MIR 1267 | 2 | 122 | MIR 1809 | 1 |
| 58 | MIR 1268 | 3 | 123 | MIR 1901 | 2 |
| 59 | MIR 1269 | 3 | 124 | MIR 1902 | 2 |
| 60 | MIR 1270 | 3 | 125 | MIR 1903 | 2 |
| 61 | MIR 1271 | 2 | 126 | MIR 1904 | 1 |
| 62 | MIR 1272 | 1 | 127 | MIR 1905 | 1 |
| 63 | MIR 1273 | 3 | 128 | MIR 1906 | 1 |
| 64 | MIR 1274 | 3 | 129 | MIR 2001 | 2 |
| 65 | MIR 1278 | 1 | 130 | MIR 2002 | 2 |
| Mean 2.6 | | | | | |
| SE(m)± 0.59 | | | | | |
| LSD (*P*<0.05) 1.42 | | | | | |

## References


1. AICPMIP. Annual Report. All India Coordinated Pearl Millet Improvement Project. Indian Council of Agricultural Research, Mandor, Jodhpur 2011-12.
2. Bidinger FR, Mahalakshmi V, Rao GDP. Assessment of drought resistance in pearl millet [*Pennisetum americanum* (L.) Leeke]. I. Factors affecting yield under stress. Aust. J Agric. Res 1987;38:37–48.
3. Kato H. Rice blast control. Pesticide Outlook 23-25. Japan crop protection association (JCPA), Japan 2001.
4. Kumar A, Tomer V, Kaur A *et al*. Millets: a solution to agrarian and nutritional challenges. Agric & Food Secur 2018;7:31. https://doi.org/10.1186/s40066-018-0183-3.
5. Lukose CM, Kadvani DL, Dangaria CJ. Efficacy of fungicides in controlling blast disease of pearl millet. Indian Phytopathol 2007;60:68–71.
6. Rai KN, Gowda CLL, Reddy BVS, Sehgal S. The potential of sorghum and pearl millet in alternative and health food uses. Compr. Rev. Food Sci. Food Saf 2008;7:340–352.
7. Timper P, Wilson JP, Johnson AW, Hanna WW. Evaluation of pearl millet grain hybrids for resistance to *Meloidogyne* spp. and leaf blight caused by *Pyricularia grisea*. Plant Dis 2002;86:909-914.
8. Singh SK, Solanki RK, Kakani RK. Pearl millet blast disease caused by *Pyricularia pennisetigena* in western arid Rajasthan, India. Current Sci 2020;119(10):1690-1694.
9. Wilson JP, Gates RN. Forage Yield losses in hybrid pearl millet due to leaf blight caused primarily by *Pyricularia grisea*. Phytopathology 1993;83:739-743.
10. Yadav OP, Rai KN. Genetic improvement of pearl millet in India. Agric. Res 2013;2:275–292.
11. Yadav OP, Rai KN, Rajpurohit BS, Hash CT, Mahala RS, Gupta SK *et al*. Twenty-five Years of Pearl Millet Improvement in India. All India Coordinated Pearl Millet Improvement Project, Jodhpur 2012.