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# Screening of Pearl Millet Lines against Downy Mildew Incited by *Sclerospora graminicola* (Sacc.) J. Schrot in Madhya Pradesh, India

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***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

Pearl millet (*Pennisetum glaucum* L.) is the oldest cultivated crop prone to attack by many pathogens *viz*., *Sclerospora graminicola*, *Moesziomyces penicillariae* and *Puccinia substriata*. The present investigation is on the management of the downy mildew pathogen by exploiting the resistance mechanism of the host. Out of 163 lines and two checks were tested against downy mildew disease. The germplasms were screened in the downy mildew sick plot. The finding exposes that 40 lines were never present of downy mildew and another 68 lines showed < 5% and > 10% downy mildew incidence was recorded in 23 lines and remaining 33 lines were recorded in the category of 5-10% incidence, while a maximum of 83.27 and 97.05% downy mildew incidence was noted in 7042-S at 30 and 60 days after sowing. When compared to all the test lines, the susceptible check 7042-S showed considerably greater incidence of downy mildew at 30 and 60

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days. The present investigation suggests that the resistance in the Pearl millet germplasms can be exploited for the management of the pathogens and is an effective management practice with less use of inputs.

*Keywords: Bajra; downy mildew; Sclerospora graminicola; screening lines.*

## 1. INTRODUCTION

Pearl millet (*Pennisetum glaucum* L.) is one of the oldest cultivated crops of Asian and African countries. India is considered to be the secondary for pearl millet diversity [1]. Pearl millet is also cultivated during summer season (FebruaryMay) in parts of Gujarat, Rajasthan and Uttar Pradesh; and during the post-rainy (Rabi) season (November-February) at a small scale in Maharashtra and Gujarat. Madhya Pradesh ranks 7th in area 0.33 million hectares with 0.74 million tonnes production and 2256 kg/ha productivity [2]. Morena, Bhind, Gwalior, Sheopur and Datia jointly contribute more than 80% production of bajra In Madhya Pradesh. Although the crop is quite hardy, it suffers from various biotic stresses. In particular, downy mildew caused by *Sclerospora graminicola* (Sacc.) Schroet. is widespread and destructive.

Downy mildew disease causes reduction in the plant height, number of leaves and nodes in susceptible cultivars. As a result, grain and fodder yields are reduced. Symptoms often vary according to host, time of expression and ambient conditions [3]. According to various researchers, downy mildew induced by *Sclerospora graminicola* (Sacc.) Schroet is the most pervasive and destructive disease of pearl millet in India [4]. Other diseases of pearl millet caused by Bacteria, Viruses, and Nematodes have also been reported. The estimated annual grain yield loss due to downy mildew is approximately 20-40% [5-7]. But this could be much higher under favourable conditions of disease development [8,9]. Data obtained from these screening techniques are highly variable on account of environmental factors [10]. In common screening studies for downy mildew resistance programs, the host cultivars are frequently cultivated in soil that has been infected with the pathogen, with infector rows of a highly sensitive cultivar, or in a greenhouse environment employing leaf whorl inoculation of early seedlings with sporangia/zoospores. In both instances, disease incidence is scored 30 to 60 days after planting [11-13]. The present study was therefore undertaken to estimate the pearl millet germplasm to find out resistance against downy mildew.

## 2. MATERIALS AND METHODS

### 2.1 Screening of Pearl Millet Material against Downy Mildew

The present research work was conducted in research field of farm, Gwalior, Madhya Pradesh. Out of 163 lines and two checks were estimated against downy mildew disease. The germplasms were screened in the downy mildew sick plot. All experiment was conducted in randomized block design maintaining three replications for each entry. Data collection on the basis of symptoms of plant was done at 30 and 60 days of plant growth stage. The percent disease incidence was also recorded for each test lines to see the disease impact on the plants. The following formula was used for the calculation of the percent wilt incidence.

The field screening technique which was developed by Williams et al*.* [12]. The downy mildew incidence on the plants of selected patches was recorded with the help of following formula:

$$\text{Downy mildew incidence (\%)} = \frac{\text{Downy mildew infected plants}}{\text{Total number of plants}} \times 100$$

## 3. RESULTS AND DISCUSSION

### 3.1 Field Screening of Pearl Millet Lines

Out of 163, according to the data compiled in (Table 1), 40 lines *viz* : MH 1486, MH 1492, MH 1496, MH 1486, MH 1492,MH 1496, MH 1516, MH 1519, MH 1541, MH 1546, MH 1534, MH 1570, MH 1575, MH 1578, MH 1588, MH 1600, MH 1605, MH 1606, MH 1607, MH 1610, MH 1614, MH 1616, MH 1620, MH 1621, MH 1628, MH 1632, MH 1639, MH 1641, MH 1650, MH 1657, MH 1658, MH 1659, MH 1661, MH 1667, MH 1670, MH 1675, MH 1676, MH 1680, MH 1681, MH 1682, MH 1683, MH 1685 and MH 1688 were readily apparent of downy mildew. The downy mildew incidence in the other 68 entries was less than 5%. A high of 83.27 and 97.05% downy mildew incidence were reported

in 7042 S at 30 and 60 days after sowing, respectively. Twenty-three entries had more than 10% downy mildew incidence recorded, while the remaining 33 entries were placed in the category of 5-10% incidence. When compared to all the test lines, the susceptible check 7042S showed considerably greater incidence of downy mildew at 30 and 60 days. The incidence of downy mildew in the local susceptible population was 23.93 and 35.35% at 30 and 60 days after sowing. This was significantly higher than the incidence in the 160 entries and on par with 852B and 81B, but significantly lower than the incidence in ICML 22, where the incidence was 65.5 and 89.8% at 30 and 60 days after sowing, respectively.

**Table 1. Screening of pearl millet lines against downy mildew**

| S. No. | Entry | Per cent incidence at | | S. No. | Entry | Per cent incidence at | |
|---|---|---|---|---|---|---|---|
| | | 30 DAS | 60 DAS | | | 30 DAS | 60 DAS |
| 1 | MH 1477 | 1.30 | 2.80 | 46 | MH 1608 | 0.00 | 1.50 |
| 2 | MH 1475 | 1.50 | 4.80 | 47 | MH 1609 | 3.00 | 3.00 |
| 3 | MH 1486 | 0.00 | 0.00 | 48 | MH 1610 | 0.00 | 0.00 |
| 4 | MH 1492 | 0.00 | 0.00 | 49 | MH 1614 | 0.00 | 0.00 |
| 5 | MH 1496 | 0.00 | 0.00 | 50 | MH 1616 | 0.00 | 0.00 |
| 6 | MH 1497 | 1.20 | 2.70 | 51 | MH 1617 | 0.00 | 3.00 |
| 7 | MH 1516 | 0.00 | 0.00 | 52 | MH 1620 | 0.00 | 0.00 |
| 8 | MH 1519 | 0.00 | 0.00 | 53 | MH 1621 | 0.00 | 0.00 |
| 9 | MH 1522 | 1.60 | 1.60 | 54 | MH 1425 | 1.50 | 1.45 |
| 10 | MH 1523 | 1.65 | 3.55 | 55 | MH 1626 | 0.00 | 3.20 |
| 11 | MH 1524 | 3.50 | 5.20 | 56 | MH 1628 | 0.00 | 0.00 |
| 12 | MH 1533 | 0.00 | 3.30 | 57 | MH 1629 | 1.50 | 1.50 |
| 13 | MH 1537 | 1.65 | 3.40 | 58 | MH 1630 | 5.00 | 7.50 |
| 14 | MH 1538 | 4.70 | 8.10 | 59 | MH 1631 | 2.60 | 2.60 |
| 15 | MH 1540 | 0.00 | 2.40 | 60 | MH 1632 | 0.00 | 0.00 |
| 16 | MH 1541 | 0.00 | 0.00 | 61 | MH 1633 | 3.30 | 5.00 |
| 17 | MH 1542 | 0.00 | 1.65 | 62 | MH 1634 | 0.00 | 1.35 |
| 18 | MH 1543 | 0.00 | 2.80 | 63 | MH 1635 | 4.00 | 5.50 |
| 19 | MH 1546 | 0.00 | 0.00 | 64 | MH 1636 | 1.50 | 1.50 |
| 20 | MH 1549 | 1.65 | 1.65 | 65 | MH 1637 | 4.15 | 4.15 |
| 21 | MH 1552 | 0.00 | 1.80 | 66 | MH 1638 | 1.40 | 2.80 |
| 22 | MH 1553 | 0.00 | 1.30 | 67 | MH 1639 | 0.00 | 0.00 |
| 23 | MH 1534 | 0.00 | 0.00 | 68 | MH 1640 | 3.50 | 5.50 |
| 24 | MH 1559 | 0.00 | 3.00 | 69 | MH 1641 | 0.00 | 0.00 |
| 25 | MH 1560 | 3.00 | 4.25 | 70 | MH 1642 | 0.00 | 1.50 |
| 26 | MH 1561 | 0.00 | 5.15 | 71 | MH 1643 | 1.40 | 1.40 |
| 27 | MH 1564 | 1.30 | 3.00 | 72 | MH 1644 | 0.00 | 1.40 |
| 28 | MH 1566 | 2.85 | 6.25 | 73 | MH 1645 | 4.50 | 4.50 |
| 29 | MH 1570 | 0.00 | 0.00 | 74 | MH 1646 | 0.00 | 2.60 |
| 30 | MH 1575 | 0.00 | 0.00 | 75 | MH 1647 | 0.00 | 1.30 |
| 31 | MH 1576 | 0.00 | 2.90 | 76 | MH 1648 | 1.50 | 1.50 |
| 32 | MH 1578 | 0.00 | 0.00 | 77 | MH 1649 | 0.00 | 1.80 |
| 33 | MH 1580 | 0.00 | 2.80 | 78 | MH 1650 | 0.00 | 0.00 |
| 34 | MH 1587 | 0.00 | 1.50 | 79 | MH 1651 | 3.40 | 4.90 |
| 35 | MH 1588 | 0.00 | 0.00 | 80 | MH 1652 | 7.50 | 10.80 |
| 36 | MH 1598 | 0.00 | 3.10 | 81 | MH 1653 | 1.60 | 3.00 |
| 37 | MH 1600 | 0.00 | 0.00 | 82 | MH 1654 | 2.70 | 2.70 |
| 38 | MH 1601 | 0.00 | 1.50 | 83 | MH 1655 | 1.30 | 1.30 |
| 39 | MH 1604 | 0.00 | 1.30 | 84 | P 3281-1 | 3.70 | 9.20 |
| 40 | MH 1605 | 1.30 | 0.00 | 85 | 843 B | 6.76 | 11.11 |
| 41 | MH 1656 | 0.00 | 1.70 | 86 | 843-22 B | 7.81 | 10.96 |
| 42 | MH 1657 | 0.00 | 0.00 | 87 | MH 1659 | 0.00 | 0.00 |
| 43 | MH 1658 | 0.00 | 0.00 | 88 | MH 1660 | 1.25 | 2.45 |
| 44 | MH 1606 | 0.00 | 0.00 | 89 | MH 1661 | 0.00 | 0.00 |

| S. No. | Entry | Per cent incidence at | | S. No. | Entry | Per cent incidence at | |
|---|---|---|---|---|---|---|---|
| | | 30 DAS | 60 DAS | | | 30 DAS | 60 DAS |
| 45 | MH 1607 | 0.00 | 0.00 | 90 | MH 1662 | 2.70 | 5.40 |
| 91 | MH 1663 | 1.50 | 2.75 | 128. | H77/833-2 | 3.45 | 6.96 |
| 92 | MH 1664 | 0.00 | 1.35 | 129. | H 77/833-2-202 | 2.09 | 3.47 |
| 93 | MH 1665 | 3.40 | 6.80 | 130. | ICMR 01007 | 3.66 | 5.40 |
| 94 | MH 1666 | 0.00 | 4.40 | 131. | ICMR 451-P6 | 7.38 | 11.42 |
| 95 | MH 1667 | 0.00 | 0.00 | 132. | HHB 67 | 8.85 | 11.46 |
| 96 | MH 1668 | 2.80 | 4.30 | 133. | HHB 67-1 Improv. | 2.41 | 6.47 |
| 97 | MH 1669 | 4.15 | 5.45 | 134. | HHB 67-2 Improv. | 1.36 | 3.82 |
| 98 | MH 1670 | 0.00 | 0.00 | 135. | 20 K 86 | 10.34 | 10.98 |
| 99 | MH 1671 | 1.20 | 1.20 | 136. | JMSB 101 | 14.82 | 26.02 |
| 100 | MH 1672 | 4.10 | 5.60 | 137. | RHRB 58 | 2.20 | 4.94 |
| 101 | MH 1673 | 1.30 | 1.30 | 138. | RHRB 1B | 9.61 | 13.63 |
| 102 | MH 1674 | 5.60 | 8.60 | 139. | J 2340 | 5.47 | 10.06 |
| 103 | MH 1675 | 0.00 | 0.00 | 140. | ICMR 312 | 2.61 | 5.85 |
| 104 | MH 1676 | 0.00 | 0.00 | 141. | 89111 B | 3.03 | 5.57 |
| 105 | MH 1677 | 1.60 | 1.60 | 142. | PPMI 301 | 2.66 | 3.65 |
| 106 | MH 1678 | 4.80 | 9.25 | 143. | HMS 7 B | 10.17 | 13.76 |
| 107 | MH 1679 | 1.40 | 1.40 | 144. | 95222 B | 6.18 | 10.13 |
| 108 | MH 1680 | 0.00 | 0.00 | 145. | HTP 94/54 | 2.90 | 6.58 |
| 109 | MH 1681 | 0.00 | 0.00 | 146. | 81 B | 24.82 | 32.01 |
| 110 | MH 1682 | 1.50 | 0.00 | 147. | 95444 B | 13.81 | 29.38 |
| 111 | MH 1683 | 0.00 | 0.00 | 148. | 88004 B | 5.47 | 8.95 |
| 112 | MH 1684 | 0.00 | 0.00 | 149. | RIB 3135 - 18 | 6.37 | 10.66 |
| 113 | MH 1685 | 2.80 | 2.80 | 150. | G -73-107 | 3.59 | 5.23 |
| 114 | MH 1686 | 0.00 | 1.65 | 151. | 700481-21-18 | 6.85 | 11.13 |
| 115 | MH 1687 | 2.00 | 4.50 | 152. | IP5272-1 | 5.77 | 13.59 |
| 116 | MH 1688 | 0.00 | 0.00 | 153. | P 2895-3 | 0.83 | 2.70 |
| 117 | MH 1689 | 5.05 | 6.80 | 154. | P 536-2 | 1.61 | 3.33 |
| 118 | MH 1690 | 1.40 | 2.80 | 155. | PT 4450 | 7.30 | 11.58 |
| 119 | P 7 – 4 | 5.90 | 7.45 | 156. | RB-14 | 10.70 | 16.75 |
| 120 | P 310 – 17 | 5.15 | 10.20 | 157. | MRB-15 | 4.07 | 6.71 |
| 121 | 700651 | 5.60 | 6.40 | 158. | MJC-1 | 5.39 | 4.28 |
| 122 | 852 B | 24.40 | 32.70 | 159. | RB-13 | 2.91 | 5.13 |
| 123 | 834 B | 5.40 | 9.70 | 160. | RB-1 | 3.96 | 7.13 |
| 124 | IP 18292 | 2.75 | 4.90 | 161. | MRB-9 | 2.42 | 3.24 |
| 125 | IP 18293 | 5.60 | 9.58 | 162. | MJC –2 | 1.76 | 2.67 |
| 126 | IP 18294 | 4.40 | 6.60 | 163. | MRB-8 | 4.01 | 10.27 |
| 127. | ICML 22 | 65.50 | 89.80 | | | | |
| Local Susceptible (Check) | | | | 23.93 | | 35.35 | |
| 7042 S (Check) | | | | 83.27 | | 97.05 | |
| **SE(m) ±** | | | | **1.15** | | **1.65** | |
| **CD at 5%** | | | | **3.21** | | **4.62** | |

**Mean of two replications*
*(DAS)-Days after sowing*

Present study on pearl millet field screening of 163 lines and two checks were tested against downy mildew disease. The finding exposes that forty lines were free from downy mildew and another 68 lines showed less than 5% downy mildew incidence. More than 10% incidence was recorded in twenty-three lines and remaining thirty-three lines were recorded in the category of 5-10% incidence, while a maximum of 83.27 and 97.05% downy mildew incidence was noted in 7042-S at 30 and 60 days after sowing. When compared to all the test lines, the susceptible check 7042-S showed considerably greater incidence of downy mildew at 30 and 60 days. It was significantly less common than ICML 22, where the incidence of downy mildew was recorded at 65.5 and 89.8% at 30 and 60 days after sowing. The downy mildew incidence in local susceptible was 23.93 and 35.35% at 30 and 60 days after sowing, respectively. In previous studies, evaluated germplasm accessions from many pearls' millet growing countries for resistance to downy mildew. The highest frequency of downy mildew resistance source was detected in accessions from the West Africa followed by East Africa [14]. In their evaluations of various germplasms, [15], (Laktake et al. 2008), and [16] noted significant variation in downy mildew incidence between genotypes.

## 4. CONCLUSION

The present investigation well estimated the pearl millet germplasm to find out resistance against downy mildew. The finding showed that the resistance in the Pearl millet germplasms can be exploited for the management of the pathogens and is an effective management practice with less use of inputs.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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