

## Screening of Rapeseed and mustard genotypes against *Alternaria* blight disease and its development of in the field condition in Assam



### Botany

**KEYWORDS:** *Alternaria* blight, disease incidence, genotypes, mustard, rapeseed,

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### ABSTRACT

The study was conducted with the objective to assess the resistance source against *Alternaria* blight in rapeseed-mustard at Instructional cum research farm, AAU, Jorhat, Assam, during Rabi 20012-13 and 2013-14. None of the genotypes was found to be highly resistant against *Alternaria* blight of rapeseed and mustard. Four genotypes were rated as moderately resistant (MR). Sixteen genotypes were marked as moderately susceptible (MS). The susceptible (S) group comprised of nine genotypes. Control (TS 38) was found highly susceptible (HS) towards blight disease exhibiting the highest disease incidence of 80.56 per cent on leaves and 76.66 per cent on pods. Significant differences on disease development among 30 genotypes of rapeseed and mustard against *Alternaria* blight were observed for the components (number of spots and spots size on leaves and pods) and time interval. In case of number of spots per leaf, at 80 DAS, lowest number of spots was found in Pusa Mustard 25 (13.40) while at 60 DAS, lowest numbers of spots was found in Pusa Mustard 28 (12.11). Highest number of spots/leaf was 54.56 at 80DAS in TS 38, a highly susceptible variety. In case of number of spots/pod, lowest number of spots was found in NRCR 601(11.00) at 100 DAS. Again TS 38 got the highest number of spots/pods (39.35) at 100 DAS. Smallest size of spots (mm) on leaves was found at 80 DAS in Pusa Mustard 28 (14.81). Largest size of spots was found in TS 38 with 52.30mm at 80 DAS. In case of pods, smallest spot size was 12.65mm at 100 DAS in Pusa Mustard 27. TS 38 got the largest spot i.e., 41.07mm at 100 DAS.

### Introduction

India is said to be the paradise for oilseed crops accounting as fourth largest oilseed producing country in the world, next to USA, China and Brazil. (Jha *et al.*, 2012). Among different oilseeds, groundnut, rapeseed-mustard and soybean account for about 80.00 per cent of area and 87.00 per cent of production of oilseeds in the country and rapeseed and mustard alone contributes 32.00 per cent of total oilseed production in India (Jha *et al.*, 2012). In 2012-13, total production was 78.20 lakh tones with an area of 6.92m ha and yield of 1307kg/ha while in 2013-14, it was targeted to produce 74.90 lakh tones with an yield of 1147kg/ha (ADS, 2013), thus playing a pivotal role in agricultural economy of the country. The production of Rapeseed and Mustard in our country has been increasing by leaps and bounds in the last few years. But still, a wide gap is found to exist between the potential yield and the yield realized at the farmer's field, which is largely because of a number of biotic and abiotic stresses to which it is exposed. Abiotic factors include non-availability of high yielding varieties and fluctuations in weather conditions. Among the biotic stressors, *Alternaria* blight (*Alternaria* spp.) is the most important and prime disease that causes havoc in Rapeseed and Mustard production is the *Alternaria* blight disease. India is facing serious yield and quality loss in production due to this pathogen (Sharma *et al.*, 2013). *Alternaria* blight disease caused by *Alternaria* spp. has been reported from all the continents of the world and is one among the important diseases of the crop in India causing up to 47.00 per cent yield losses (Kolté, 1985) with no proven source of transferable resistance in any of the host. Saharan, 1992; and Kolté, 2002 reported that *Alternaria* blight sometimes causes more severe losses (up to 70.00%) in rapeseed (*Brassica campestris*). The average yield losses are in the range of 32.00-57.00 per cent as reported by Shrestha *et al.* 2005.

*Alternaria* blight severity on rapeseed-mustard differs among seasons and regions and also between individual crops within a region. This may be due to existence of variability within the isolates of *Alternaria* spp. (Meena *et al.*, 2005; and Verma *et al.*, 2006). The economical and environmentally safe method of controlling the disease is the use of resistant varieties. Proper information and studies are not done for resistant sources (Shah *et al.*, 2005; Rajendra *et al.*, 2002). Severity of *Alternaria* blight on oilseed Brassicas differs between seasons, regions and individual crops within a region in India. However, there is an absence of stable, desirable and diverse source of resistance to the *Alternaria* blight of mustard (Chattopadhyay and Bhaggi, 1994). In Assam rapeseed and mustard is mostly cultivated as sole crop with an objective of producing edible oil, as almost the entire population of Assam

utilizes this oil as the main source of edible oil. However, in Assam, despite its importance, not much research work has been done regarding pathogenic variation, varietal screening, resistance variety and epidemiological studies. Keeping in view, the cost and environmental hazards associated with the use of chemicals, cultivation of varieties resistant to the disease is a better option for its management so the present investigation on screening of Rapeseed and mustard genotypes against *Alternaria* blight disease and its development of in the field condition in Assam was done.

### Materials and methods

#### Geographical location of the Experimental site

The present investigation was carried out at the Information cum research farm (ICR), Assam Agricultural University, Jorhat. The farm is situated at 26°47' N latitude, 94°12' E longitude and at an altitude of 86.6m from the mean sea level.

#### Screening of Rapeseed and Mustard genotypes against *Alternaria* blight

A field experiment (Plate 3.7a, 3.7b, 3.7c and 3.7d) was conducted to find out the sources of resistance to *Alternaria* blight of Rapeseed and Mustard at Information cum research farm, AAU, Jorhat, during rabi 2012-13 and 2013-14. A total of thirty entries were collected from RARS, Shillongoni as well as from National Seed Project, AAU, Jorhat and evaluated. All the entries were sown in single line of three meter length. Prior to sowing the seeds were tested by blotter method and found that there was 95.00 per cent germination. A susceptible variety TS-38 was sown in between five test entries and all around the experimental block 15 days prior to sowing of test entries. To create maximum disease pressure in the field, repeated inoculations at 35, 50 and 65 DAS of spore suspension ( $1 \times 10^5$  conidia/ml) on the rapeseed mustard plants were given and higher dose (80kg/ha) of nitrogen was applied. Observations for initial appearance of disease symptoms and the disease index at 30 to 90 days (depending on variety) after sowing were recorded, using 0 to 5 scale given by Wheeler, 1969 as described earlier. Record of first appearance of the disease spot was also recorded in each of the thirty genotypes. as described by All India Coordinated Research Project on Rapeseed and Mustard, Pathology, Planning and Review Session (2001-02) as described in Table 3.3 (Anonymous 2002).

The percent disease index (PDI) was calculated using the formula (Wheeler, 1969)

$$PDI = \frac{\text{Sum of individual rating}}{\text{Number of leaves examined} \times \text{Maximum disease grade}} \times 100$$

**Table 1. Modified 0-5 scale disease severity of Alternaria blight in rapeseed-mustard**

| Grade/ Rating scale | Description on Disease severity   | Disease/Pathogen Reaction |
|---------------------|---|---------------------------|
| 0                   | No symptoms on the leaf   | Highly resistant          |
| 1                   | Small circular, scattered, brown spots covering 1 to 10 percent of leaf area and infection on lower most leaves of the plant.   | Resistant                 |
| 2                   | Spots enlarging, dark brown in color covering 11 to 25per cent of leaf area   | Moderately resistant      |
| 3                   | Spots enlarging, dark brown in color covering 26 to 50 per cent of leaf area  | Moderately susceptible    |
| 4                   | Spots dark brown, coalescing, covering 51 to 75 per cent of the leaf area.  | Susceptible               |
| 5                   | Spots uniformly dark brown, coalescing. Severe infection on all leaves infested to a greater degree covering 76 to 100 percent. | Highly susceptible        |

### Development of Alternaria blight in Rapeseed and Mustard genotypes under field conditions

Thirty genotypes of rapeseed-mustard under varietal screening were further used to study the development of the Alternaria blight under field conditions. The numbers of spots were counted/leaf area and pod area at randomly tagged plants with the help of glass slide. Observations were taken randomly at four places/leaf lamina on upper surface of the leaf, starting from lower leaf to the uppermost fully developed leaves. Spots were also counted on pods one week prior to maturity. Diameter of randomly selected spots was measured in mm including yellow halo chlorotic area with necrotic brown area in the center. Spots were measured in the same leaf and in the same sequence starting from lower to upper leaf in each observation. Average size of leaf spot on different leaf positions on five selected plants in each genotype was calculated. Five largest spots of the infected pods were measured and average was taken on the basis of 50 spots/genotype (Kumar and Singh, 2006).

### Results and discussion

#### Reaction of rapeseed and mustard genotypes against Alternaria blight under natural conditions

Screening of rapeseed-mustard genotypes were done at ICR farm, AAU, Jorhat, revealed that among 30 genotypes, none was found immune or highly resistant against Alternaria blight of rapeseed-mustard as shown in Table 2. Initial appearance of the disease ranged 30 days to 60 days after sowing. Four genotypes viz., Pusa Mustard-27, Pusa Mustard-25, Pusa Mustard-28 and Sej-2 with disease index of 23.56, 25.00, 25.00 and 24.55 per cent on leaves and 11.55, 13.34, 15.56 and 20.88 per cent on pods respectively, were rated as moderately resistant (MR).

Sixteen genotypes were recorded as moderately susceptible (MS) in which disease index was found to be 66.95, 49.90, 45.56, 46.67, 42.45, 46.67, 45.66, 56.66, 47.78, 48.78, 50.00, 45.55, 46.66, 47.87, 50.00 and 49.78 per cent on leaves and 40.02, 28.67, 26.05, 27.85, 26.00, 27.05, 30.87, 32.65, 35.76, 36.76, 34.47, 35.45, 37.22, 40.45 and 39.77 per cent in pods respectively. These lines were Binoy, Pusa Mustard 22, Pusa Mustard 26, Pusa Bahar, Pusa Bijoy, Pusa Jagannath, Pusa Bold, Pusa Mustard 24, Pusa Tarak, JT-90-1, NRCDR 601, NDRE 7, RGN 145, NDRE 4, NRCDR 02 and VSH 401.

The susceptible (S) group comprised of nine genotypes namely, TS 62, TS 67, TS 65, TS 50, NHI-100, PRE 2007-6, NRCHB101, Anuradha (Toria) and Maya with 74.96, 74.67, 74.78, 70.76, 75.00, 70.87, 70.88, 70.55 and 70.78 per cent infection on leaves and 51.55 51.06, 52.05, 41.90, 55.55, 56.78, 56.88, 59.48 and 60.65 per cent on pods, respectively.

Control (TS 38) was found highly susceptible (HS) towards blight disease exhibiting the highest disease index of 80.56 per cent on leaves and 76.66 per cent on pods.

Likewise, on one of the field experiment as reported by Yadav *et al.* (2014), none of the 31 varieties/lines screened against blight of the rapeseed-mustard was found immune or HR. The variety NPN- 1 was found to be resistant with only 9.2 per cent incidence of disease. Five genotypes viz. NPC-15, PBC-2004-1, PRQ-2004-1, NDR-03-06 and PR-2003-30 were found to be MR. Ten lines were found to be MS exhibiting 26.00 to 50.00 per cent disease incidence. Nine lines were categorized as S (51.00 to 75.00 per cent disease incidence) and HS group comprised of 6 lines. Among all, line NPJ-102 exhibited the highest disease incidence (79.2%).

Summuna *et al.* (2012), assessed that out of 27 genotypes, two genotypes showed MR against the disease (>10-20%) while four genotypes viz. showed MS (>20-30%) and eighteen genotypes were found to be S recording disease severity ranging from 30.00-50.00 per cent. Three genotypes showed HS and the disease severity was found to be more than 50.00 per cent. Rahman *et al.* (2010), found varying degree of disease severity while evaluating 26 varieties/lines of rapeseed-mustard during their extensive research on blight at RARS, Jamalpur. On the basis of disease severity index, none was found highly resistant or resistant while six among them appeared to be MR against the blight.

#### Development of Alternaria blight on thirty genotypes of Rapeseed and Mustard under field conditions

Significant differences in the development of Alternaria blight disease among thirty genotypes along with the time interval were observed for the two components of the disease resistance i.e., number of spots and size of spots on both leave and pods (Table 3).

#### Development of spots on leaves

In case of number of spots per leaf, least number of spots was found in Pusa Mustard 25 (13.40) at 80 DAS and 13.24 at 60 DAS on leaf while in Pusa Mustard 28, number of spots/leaf was 14.41 at 80 DAS and 12.11 at 60 DAS. Highest number of spots/leaf was 54.56 at 80 DAS and 35.93 at 60 DAS which was found in TS 38, a highly susceptible variety.

#### Development of spots on pods

In case of number of spots/pod, least number of spots was observed in NRCDR 601 and it was 11.00 at 100DAS. However, TS 38 got the highest number of spots/pod (39.35) at 100 DAS.

#### Size of spots on leaves

Another component was the development of the size of spots (mm) on both leaves. Here, on leaf, the lowest size of spot was found in genotype NRCDR 601 with 12.28mm at 60 DAS and in Pusa Mustard 28, it was 14.81mm at 80 DAS. Largest size of spots was observed in TS 38 with 50.05mm at 60 DAS and 52.30mm at 80 DAS.

**Size of spots on pods**

In case of pods, lowest size was 12.65mm at 100 DAS in Pusa Mustard 27 while TS 38 got the largest size of spots i.e., 41.07mm at 100 DAS.

Likewise significant differences were found among 30 genotypes against the same disease for the same components by Kumar and Singh (2006) and found that PR 9031(12.50mm) and PR 8988 (27.30 mm) exhibited highest blighted area on leaves and pods respectively. Genotype PR 9024 exhibited slow blighting in terms of area and number of spots. PR 9031 exhibited highest number of spots/cm square (9.60) on leaves and on pods (67.00). Development of disease found to be greater in later DAS (62 to 72 DAS on leaves and 100 to 110 DAS on pods). The reduced size of spot indicated the resistance reaction, while the increased spot size indicated susceptibility. The size of spot could be used as a parameter of resistance (Singh and Singh, 2004). Number of spots/unit area was also an important parameter of disease development because greater number of spot covered more diseased area (Kushwaha and Narain, 2005).

**Table 2. Reaction of different Rapeseed and Mustard genotypes against Alternaria blight under natural conditions**

| Genotypes       | First appearance of disease (Days after sowing) | Per cent disease severity |       | Disease Reaction |
|-----------------|---|---------------------------|-------|------------------|
|                 |   | Leaves                    | Pods  |                  |
| TS 38           | 30  | 80.56                     | 76.66 | HS               |
| TS 62           | 40  | 74.96                     | 51.55 | S                |
| TS 67           | 42  | 74.67                     | 51.06 | S                |
| TS 65           | 45  | 74.78                     | 52.05 | S                |
| TS 50           | 45  | 70.76                     | 41.90 | S                |
| Pusa Mustard 22 | 54  | 49.90                     | 28.67 | MS               |
| Pusa mustard 26 | 60  | 45.56                     | 26.05 | MS               |

| Genotypes        | First appearance of disease (Days after sowing) | Per cent disease severity |       | Disease Reaction |
|------------------|---|---------------------------|-------|------------------|
|                  |   | Leaves                    | Pods  |                  |
| Pusa Bijoy       | 56  | 42.45                     | 26.00 | MS               |
| Pusa Jagannath   | 54  | 46.67                     | 27.05 | MS               |
| Pusa Mustard-27  | 52  | 23.56                     | 11.55 | MR               |
| Pusa Mustard-25  | 56  | 25.00                     | 13.34 | MR               |
| Pusa Mustard-28  | 54  | 25.00                     | 15.56 | MR               |
| Pusa Bold        | 55  | 45.66                     | 30.87 | MS               |
| Pusa Mustard -24 | 57  | 47.78                     | 32.65 | MS               |
| Pusa Tarak       | 54  | 48.78                     | 35.76 | MS               |
| JT-90-1          | 48  | 50.00                     | 36.76 | MS               |
| NH1-100          | 47  | 75.00                     | 55.55 | S                |
| PRE 2007-6       | 50  | 70.87                     | 56.78 | S                |
| NRCHB-101        | 50  | 70.88                     | 56.88 | S                |
| NRCDR-601        | 56  | 46.56                     | 34.44 | MS               |
| Anuradha (Torja) | 50  | 70.55                     | 59.48 | S                |
| NDRE-7           | 48  | 45.55                     | 34.47 | MS               |
| RGN-145          | 56  | 46.66                     | 35.45 | MS               |
| NDRE-4           | 45  | 47.87                     | 37.22 | MS               |
| NRCDR-02         | 46  | 50.00                     | 40.45 | MS               |
| VSH-401          | 47  | 49.78                     | 39.77 | MS               |
| SEJ-2            | 52  | 24.55                     | 20.88 | MR               |
| Maya             | 50  | 70.78                     | 60.65 | S                |
|                  |   |                           |       |                  |

**Table 3. Development of Alternaria blight on the different genotypes of rapeseed and mustard under field conditions**

| Genotypes        | No. of spots/ leaf |        | No of spots/ pods |        | Size of spots(mm) |         |  |
|------------------|--------------------|--------|-------------------|--------|-------------------|---------|--|
|                  |                    |        | Leaves            |        | Pods              |         |  |
|                  | 60 DAS             | 80 DAS | 100 DAS           | 60 DAS | 80 DAS            | 100 DAS |  |
| TS 38            | 35.93              | 54.56  | 39.35             | 50.05  | 52.30             | 44.06   |  |
| TS 62            | 23.50              | 25.45  | 39.20             | 45.07  | 41.43             | 39.07   |  |
| TS 67            | 21.61              | 23.49  | 38.41             | 41.66  | 38.21             | 36.08   |  |
| TS 65            | 21.69              | 24.24  | 38.50             | 44.12  | 39.08             | 36.41   |  |
| TS 50            | 20.20              | 22.21  | 36.49             | 37.88  | 26.27             | 33.41   |  |
| Binoy            | 17.00              | 20.30  | 24.97             | 28.27  | 25.32             | 25.66   |  |
| Pusa Mustard 22  | 15.21              | 19.43  | 26.64             | 27.29  | 26.73             | 27.28   |  |
| Pusa mustard 26  | 15.35              | 20.44  | 24.57             | 28.16  | 24.41             | 25.21   |  |
| Pusa Bahar       | 12.50              | 15.26  | 14.60             | 17.21  | 14.93             | 14.43   |  |
| Puja Bijoy       | 16.47              | 20.33  | 25.23             | 28.17  | 26.67             | 25.99   |  |
| Pusa Jagannath   | 17.19              | 21.39  | 26.99             | 29.32  | 27.67             | 27.29   |  |
| Pusa Mustard-27  | 12.27              | 13.51  | 11.82             | 13.45  | 15.32             | 12.65   |  |
| Pusa Mustard-25  | 13.24              | 13.40  | 16.05             | 16.91  | 15.92             | 16.67   |  |
| Pusa Mustard-28  | 12.11              | 14.41  | 15.14             | 16.11  | 14.81             | 15.41   |  |
| Pusa Bold        | 15.24              | 23.33  | 25.08             | 25.41  | 24.17             | 24.24   |  |
| Pusa Mustard -24 | 14.16              | 22.33  | 25.08             | 25.16  | 24.66             | 25.24   |  |
| Pusa Tarak       | 14.75              | 23.33  | 25.08             | 25.91  | 23.81             | 24.10   |  |
| JT-90-1          | 15.17              | 24.27  | 23.15             | 24.77  | 24.27             | 24.57   |  |
| NH1-100          | 23.27              | 27.38  | 32.06             | 30.17  | 37.82             | 31.93   |  |
| PRE 2007-6       | 24.27              | 28.32  | 27.78             | 32.27  | 40.22             | 34.32   |  |
| NRCHB-101        | 24.40              | 29.49  | 28.74             | 33.12  | 40.61             | 35.32   |  |
| NRCDR-601        | 12.33              | 18.35  | 11.00             | 12.28  | 18.96             | 14.11   |  |
| Anuradha (Torja) | 32.30              | 50.22  | 38.55             | 43.91  | 48.77             | 41.32   |  |
| NDRE-7           | 14.33              | 21.22  | 24.75             | 25.91  | 23.93             | 24.33   |  |
| RGN-145          | 15.05              | 24.38  | 24.89             | 27.43  | 23.02             | 23.98   |  |
| NDRE-4           | 17.30              | 25.40  | 26.23             | 29.51  | 25.32             | 26.11   |  |

|          |       |       |       |       |       |       |
|----------|-------|-------|-------|-------|-------|-------|
| NRCDR-02 | 17.49 | 25.30 | 25.84 | 28.17 | 25.41 | 25.96 |
| VSH-401  | 15.65 | 25.38 | 25.33 | 25.99 | 24.30 | 24.60 |
| SEJ-2    | 12.19 | 14.24 | 15.35 | 15.82 | 14.85 | 15.21 |
| Maya     | 33.28 | 51.26 | 40.29 | 42.59 | 49.51 | 42.12 |
| CD (5%)  | 4.417 | 5.107 | 5.298 | 5.534 | 5.496 | 5.356 |

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