# Screening of Different Sugarcane Genotypes for Red Rot Disease Resistance

**M.O. Khaiyam*, M.I. Hossain, M.J. Uddin and M.S. Rahman**

Pathology Division
Bangladesh Sugarcrop Research Institute, Ishurdi, Pabna, Bangladesh

## ABSTRACT

A field experiment was conducted to study the level of resistance of sugarcane genotypes to red rot disease in the cropping years 2016-17 and 2017-18 against a mixed inoculum of red rot pathogen *Colletotrichum falcatum* at BSRI Ishurdi farm and RSRS, Thakurgaon farm. Thirty five genotypes were screened, among them, 4 (Isd 20, Isd 39, BSRI Akh 45 and I 169-13) were found as resistant, 16 were moderately resistant, 8 were moderately susceptible, 5 were susceptible and remaining genotypes 2 (Isd 18, Isd 28) were found as highly susceptible to red rot. The genotypes showing resistant to red rot should be included in releasing sugarcane varieties for commercial cultivation.

**Key words:** Screening, red rot, disease resistance

## INTRODUCTION

Sugarcane is one of the most important industrial cash crops in Bangladesh. Among many causes disease play an important role to decrease the yield of sugarcane as well as sugar. So far 40 sugarcane diseases have been recorded in Bangladesh of which red rot (*Colleotrichum falcatum* Went) is considered as major one (Talukder *et al.*, 2010). In some cases and under water logged condition, incidence of red rot was found 1-100% (Rahman *et al.*, 1998). In Bangladesh, some high yielding and high sugar content popular varieties have been withdrawn from commercial cultivation due to their susceptibility to red rot (Malek, 1985). It has been observed that some varieties during their release found tolerant to the existing isolates of *Colletotrichum falcatum* but after few years they become susceptible due to development of new pathotype (race). Due to changing the race of pathogen, evaluation process has to be continued so that resistant clones are ready in the pipeline to replace the susceptible ones (Shukla *et al.*, 2005). Therefore, screening of sugarcane genotypes against red rot pathogen is a pre-requisite in the varietal development program. That is why, a screening programme was conducted to find out the level of resistance of sugarcane genotypes against different isolates of red rot pathogen.

*Corresponding author: M.O. Khaiyam, Senior Scientific Officer
e-mail: princesau88@gmail.com

## MATERIALS AND METHODS

A field experiment was conducted in two locations viz., BSRI Ishurdi farm and RSRS farm, Thakurgaon during the cropping season 2016-17 and 2017-18 with 35 sugarcane genotypes comprising commercial varieties, clones under zonal yield trial ZYT III, II, I and advanced yield trial (AYT). A mixture of spore suspension ($10^6$ spore/ml) of 38 isolates of *Colletotrichum falcatum* Went collected from different agro-ecological cane growing zones of the country used as inocula. The collected isolates were cultured on oat meal agar (OMA) medium for 10-12 days to sporulate and were harvested in sterilized water adjusted to a concentration of $10^6$ spore/ml for inoculation. Inoculation was done at the age of 8 months of planting canes. Twelve canes of each clone were inoculated in the middle of the third internode above the ground level following hypodermic syringe method where puncture was done by BSRI made special needle (2 cm long and 2 mm dia.). The punctured point was covered and wrapped by insulating tape in order to prevent oxidation and contamination. After 60 days of inoculation, the inoculated canes were splitted longitudinally and were examined. After examination of splitted canes, grading were done according to symptomatic Method (Srinivasan and Bhat, 1961; Rahman *et al.*, 1996; Rahman *et al.*, 2009; Uddin *et al.*, 2013) with slight modification of criteria for calculating disease index as described in Table 1.

The mean of the total numerical ratings/scores of 10 canes was taken for assessing the disease index and disease reaction of each genotype against *Colletotrichum falcatum* was done based on following scale:

| Disease index ( score) | Disease reaction (Grade) |
|---|---|
| 0.00-2.00 | Resistant (R) |
| 2.10-4.00 | Moderately Resistant (MR) |
| 4.10-6.00 | Moderately Susceptable (MS) |
| 6.10-8.00 | Susceptable (S) |
| Above 8.10 | Highly Susceptible (HS) |

## RESULTS AND DISCUSSION

The results of disease reactions of various genotypes during 2016-17 and 2017-18 cropping seasons against mixed isolates of red rot pathogen are presented in Table 2. Out of 35 sugarcane genotypes, 4 genotypes were found resistant (R) according to overall disease reaction. The resistant genotypes were Isd 20, Isd 39, BSRI Akh 45 and I 169-13. Of them, 16 genotypes were found as moderately resistant (MR) and they were Isd 2/54, Isd 32 Isd 34, Isd 37, Isd 40, BSRI Akh 43, BSRI Akh 44, BSRI Akh 46, I 7-11, I 111-11, I 143-12, I 146-12, GT-11, I 165-13, I 210-13 and I 302-13. Among the tested genotypes 15 showed moderately susceptible (MS) to highly susceptible (HS) against red rot. Out of 15 genotypes, eight genotypes viz., Isd 19, Isd 36, Isd 38, BSRI Akh 41, I 103-10, I 230-11, GT-17 and I 280-13 were found moderately susceptible (MS). Five genotypes viz., Isd 16, Isd

33, I 36-12, I 174-13 and I 280-13 was susceptible (S) and two genotypes (Isd 18 & Isd 28) were highly susceptible (HS). There was variation in disease index score at both locations in both years (Table 2). This may be because of environmental variation and change of pathotypes in different years reported by many authors (Uddin *et al.*, 2013: Rahman *et al.*, 2009; Begum *et al.*, 2007) in some genotypes. During release of varieties for commercial cultivation all the varieties like Isd 16, Isd 18, Isd 19, Isd 28, Isd 33, Isd 36, Isd 38 and BSRI Akh 41 showed as resistant to moderately resistant reaction. At present, they are showing moderately susceptible (MS) to highly susceptible (HS) reaction. This probably happened because of changing of the pathotypes of the causal organism *Colletotrichum falcatum* and environmental factors. Similar observations were found by other scientists (Pandey *et al.*, 2007 and Solanky *et al.*, 2002). Some varieties like Isd 18 and Isd 28 have been withdrawn from commercial cultivation due their susceptibility to the disease.

For this reason, continuous breeding for resistant variety is inevitable to avoid epiphytotics to red rot (Kalaimani *et al.*, 2003). Therefore, to solve this problem it is necessary to continue breeding and selection of red rot resistant genotypes having good agronomic characters. Finally, the genotypes showing moderately resistant reaction may either be released for commercial cultivation with proper management practices or used as a source of resistance in breeding program for developing red rot resistant varieties.

**Table1. Criteria for determination of disease index for screening sugarcane genotypes against red rot**

| Sl. No. | Criteria/Characters | Numerical rating/score |
|---|---|---|
| 1. | **Lesions width above the inoculated internode (0-3)** | |
| | a) very rare lesion or no lesion developed | 0 |
| | b) Rare lesion (1/3 or less spread of full width) | 1 |
| | c) Medium lesion (1/3rd to 2/3$^{rd}$ spread of full width) | 2 |
| | d) High lesion (coved the full width) | 3 |
| 2. | **Nodal transgression (0-3)** | |
| | a) Lesion restricted in the inoculated internode | 0 |
| | b) One node crossed | 1 |
| | c) Two nodes crossed | 2 |
| | d) Three or more nodes crossed | 3 |
| 3. | **Presence of white patches (0-2)** | |
| | a) white patches absent | 0 |
| | b) white patches restricted | 1 |
| | c) white patches progressive | 2 |
| 4. | **Condition of top (0-1)** | |
| | a) Green | 0 |
| | b) Yellow/dry | 1 |

**Table 2. Reaction of different sugarcane genotypes against mixed isolates of *Colletotrichum falcatum* Went at both location during cropping season 2016-17 and 2017-18**

| Sugarcane genotypes | Disease index score against *Colletotrichum falcatum* Went | | | | Average Disease index of two years and two locations | Over all Disease reaction |
|---|---|---|---|---|---|---|
| | Cropping season 2016-17 | | Cropping season 2017-18 | | | |
| | At BSRI, Ishurdi farm | At RSRS, Thakurgaon farm | At BSRI, Ishurdi farm | At RSRS, Thakurgaon farm | | |
| Isd 2-54 | 1.20 | 1.50 | 4.35 | 3.05 | 2.5 | MR |
| Isd 16 | 8.10 | 5.00 | 8.10 | 5.55 | 6.7 | S |
| Isd 18 | 9.00 | 8.50 | 8.65 | 8.70 | 8.7 | HS |
| Isd 19 | 7.60 | 2.30 | 8.00 | 5.05 | 5.7 | MS |
| Isd 20 | 2.20 | 1.10 | 3.30 | 1.05 | 1.9 | R |
| Isd 28 | 9.00 | 8.50 | 9.00 | 8.90 | 8.9 | HS |
| Isd 32 | 2.80 | 2.40 | 4.60 | 3.80 | 3.4 | MR |
| Isd 33 | 6.90 | 5.10 | 7.05 | 5.30 | 6.1 | S |
| Isd 34 | 4.70 | 2.20 | 4.70 | 2.35 | 3.5 | MR |
| Isd 36 | 4.30 | 2.80 | 5.05 | 4.50 | 4.2 | MS |
| Isd 37 | 2.10 | 1.70 | 3.55 | 4.20 | 2.9 | MR |
| Isd 38 | 4.00 | 2.30 | 9.00 | 3.85 | 4.8 | MS |
| Isd 39 | 1.80 | 1.20 | 1.90 | 2.00 | 1.7 | R |
| Isd 40 | 4.40 | 3.00 | 2.80 | 3.75 | 3.5 | MR |
| BSRI Akh 41 | 3.20 | 2.30 | 6.15 | 4.60 | 4.1 | MS |
| BSRI Akh 43 | 3.20 | 1.60 | 7.05 | 3.70 | 3.9 | MR |
| BSRI Akh 44 | 1.00 | 1.50 | 4.80 | 4.65 | 3.0 | MR |
| BSRI Akh 45 | 0.80 | 1.20 | 2.15 | 1.45 | 1.4 | R |
| BSRI Akh 46 | 5.90 | 0.80 | 5.15 | 1.80 | 3.4 | MR |
| I 103-10 | 5.40 | 4.20 | 6.20 | 4.70 | 5.1 | MS |
| I 7-11 | 2.50 | 0.50 | 3.55 | 1.90 | 2.1 | MR |
| I 111-11 | 2.90 | 1.70 | 3.45 | 3.00 | 2.8 | MR |
| I 230-11 | 7.20 | 3.70 | 5.55 | 5.75 | 5.6 | MS |
| I 36-12 | 8.70 | 6.90 | 9.00 | 5.00 | 7.4 | S |
| I 143-12 | 4.00 | 0.90 | 2.90 | 1.70 | 2.4 | MR |
| I 146-12 | 4.80 | 0.40 | 3.05 | 2.35 | 2.7 | MR |
| GT -11 | 4.70 | 1.10 | 3.10 | 4.40 | 3.3 | MR |
| GT-17 | 5.90 | 2.90 | 7.40 | 5.10 | 5.3 | MS |
| I 165-13 | 5.30 | 1.30 | 5.80 | 2.15 | 3.6 | MR |
| I 169-13 | 2.00 | 1.20 | 1.40 | 1.75 | 1.6 | R |
| I 174-13 | 9.00 | 5.10 | 6.60 | 4.15 | 6.2 | S |
| I 193-13 | 9.00 | 6.00 | 7.30 | 3.65 | 6.5 | S |
| I 210-13 | 6.60 | 1.50 | 3.40 | 3.25 | 3.7 | MR |
| I 280-13 | 7.50 | 4.50 | 5.75 | 3.15 | 5.2 | MS |
| I 302-13 | 3.60 | 2.50 | 3.95 | 3.45 | 3.4 | MR |

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