Screening of C_{-1} Generation of Sugarcane Genotypes for Resistant to Red-Rot Disease in Eastern Uttar Pradesh

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Abstract: The incidence of plants diseases has been one of the major limiting factors in achieving the production potential of the crops. Only red rot is causing economic losses to the crop and major incidence in sugarcane growing areas of India. An experiment was conducted at GSSBRI, Seorahi, Kushinagar with collaboration of breeding programmed for autumn planted four crop sessions since 2015-17 to 2018-20. Freshly highly sporulating 7–9 days old culture of *Colletotrichum falcatum* Went; was made from petriplates were incubated at 30±1°C temperature on BOD incubator. Spore suspension at a concentration of 10^6per ml was added for inoculation of each genotype by plug method. In present study of disease reaction on 5036 genotypes was evaluated against red rot disease. After 60 days of the inoculated these genotypes was split open longitudinally along with the point of inoculation. Observations were recorded on the basis of the international scale (0–9) for assessing the screening as condition of top, lesion width, nodal transgression and white spots. In our study for 5036 genotypes were evaluated against red rot disease, out of which 1856 genotypes were found as moderately resistant (MR), 1078 genotypes were rated as moderately susceptible (MS), 977 genotypes were rated as susceptible (S), and 1042 genotypes were found highly susceptible (HS) with checks were found similar and dissimilar reaction, while rest genotypes were found water shoot phases. Consequently, these moderately resistant (MR) 1856 genotypes could be utilized in further studies in the breeding programme for developing red rot resistant clones for next generation.

Key-words: Sugarcane, Red rot, C. falcatum Went; C-1 Genotypes.
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1. Introduction

Sugarcane an improvement through breeding around the world has been progress for inter-specific hybridization progammes, which formed on the basic structure of these efforts, have resulted in the evaluation of varieties with wide adaptability and tolerance to diseases and others factor. An inter- specific hybrid produced by Barber in 1912 from a cross between *Saccharum officinarum* x *Saccharum spontanium* was the first commercial sugarcane variety Co 205 released for cultivation in India (Nair, 2007). Many such hybrid clones starting from Co 205 released in 1918 made a sugar revolution in the country, especially in the subtropical belt (Viswanathan and Selvakumar, 2020).Thereafter most of the sugarcane varieties were developed through inter-specific hybridization between the cultivated and wild *Saccharum* species, backcrossing of the hybrids of the cultivated species and their subsequent intercrossing. The successes of the early inter specific hybrids and their derivatives generated sustained interest in the collection, conservation, characterization and utilization of the *Saccharum* germplasm. Consequently, one of the largest collections of sugarcane germplasm screening for red rot resistance, which well characterized and well documented. The systematic and continued

utilization of the germplasm had been an important feature of the varietal development and improvement programme for selection of red rot resistant genotypes.

The sugarcane crop is attacked by all kinds of disease causing organism such as fungi, bacteria, viruses and phytoplasma. Also, the crop is available throughout the season in a year in the field thus exposed to the pathogens all the times. Additionally vegetative propagation favors carryover of the pathogens by their accumulation in the cane stalks. Ratooning is another factor in building up of diseases under field conditions and most of the times ratoons favour the disease develop to an epidemic levels. Infection of necrotizing pathogens like red rot/leaf scald or vascular pathogens like wilt show disease leading to the crop loss in the same season (Viswanathan and Rao, 2007). Many others pathogens causing smut, RSD, GSD, Mosaic, YLD etc accumulate in the cane over season and causes the disease in the ratoons or slowly bring down the vigour of the variety. This phenomenon is referred to as 'varietal deterioration'. Hence poor performance of the varieties due to varietal deterioration needs replacement of varieties or rejuvenation through meristem culture or heat therapy or chemotherapy or both. However, the rejuvenated planting materials introduced to the field many succumb to the disease again. Hence, going for resistant varieties is the best option available in the sugarcane breeding center in the country like ours, where still the farmers are not resourceful, lack of knowledge on integrated disease management and in many instances lack of awareness on disease infection in their crop. Several important varieties like Co 205, Co 213, Co 290, Co 301, Co 312, C o 313, Co 357, Co 370, Co 385, Co 393, Co 419, Co 421, Co 453, Co 658, BO 3, BO 11, BO 14, BO 17, BO 54, Co 997, CoS 510, CoS 562 CoS 687, CoC 671, CoC 85061, CoC 86062, CoC 92061, CoLk 8102, CoJ 82, CoJ 84, CoS 767, CoSe 93232 and CoSe 92423 have been removed from the field due to their highly susceptibility to red rot disease. These efforts resulted in the release of outstanding varieties from Sugarcane Breeding Institute which were high yielding and tolerant to major diseases resistance of sugarcane hybridization. The continuing efforts of sugarcane breeding have resulted in the red rot evaluation of sugarcane varieties from time to time to meet demand of farmer and greatly expanded sugar industry in the country.

2. Materials and methods

The experiment was conducted at Genda Singh Sugarcane Breeding & Research Institute, Seorahi with collaboration of breeding programme for autumn planted four crop sessions 2015-2017 to 2018-2020. A total 5036 genotypes were planted in augmented designin 6.0 meter single row length with spacing 90 cm. Usually three recommended national reference pathotypes (Cf07, Cf08, Cf09) prevailing in North Central and North West Zone and virulent local isolate (R1602Seo) of Seorahi, location is used for mixed inoculations of each clones by plug method. Freshly highly sporulating 7–9 days old cultures in petridishes are used for inoculums preparation. The conidial mass is harvested with 100 ml of sterile water and collected in a flask. Conidial concentration is adjusted to 10^6conidia/ml spore using a haemocytometer. The spore suspension was placed in a hole made with 20 ml hypodermic needle having 16-G size on the 3rd exposed internodes from bottom (Hussnain *et. al*, 2007). The inoculation is done in 7th month old cane in the field from first week of August. This period coincides with active monsoon season which facilitates optimum conditions for disease development. About 25 clumps are required

for taking up inoculation. In each clump at least five canes are inoculated. Inoculation is to be done in the middle of the third exposed internodes from bottom and two drops of spores are dropped into the bore hole (12 mm depth and 8 mm dia) made using a red rot inoculators (Viswanathan and Rao, 2007). The tissue block removed is placed in the same bore-hole after dropping conidial suspension and injured area is covered with modeling clay, immediately. The disease reaction on 5036 clones were evaluated against red rot for assessing the pathogenesis on the basis of the international scale (0 to 9) were adopted as suggested by Srinivasan and Bhatt (1961). After 60 days of the inoculated these genotypes was split open longitudinally along the point of inoculation for calculating the disease index.

3. Results and Discussion

Sugarcane breeding programme screening for red rot resistant clones is very important procedures of selection of varieties. In this investigation a total 5036 clones screened, 1856 clones were found moderately resistant (MR), 1078 clones were found moderately susceptible (MS), 977 clones were found susceptible (S) and 1042 clones were found highly susceptible (HS), while rest clones were found water shoot phases (Fig-1). Similarly, inter-specific hybrids and basic species in the sugarcane germplasm are screened for disease resistance regularly to prevailing pathogenic flora and are being utilized as parental clones in breeding programmes by Viswanathan et al (1998). A major part of the species- germplasm had been screened for red rot resistance. Among the *S. officinarum* germplasm 7 clones were reported to be resistant to red rot and 15 clones' moderately resistant (Sreenivasan, 1995). In their study also reported that 170 clones of *S. spontaneum* screened, 69 clones were resistant and 59 clones moderately resistant to red rot (Chaudhary *et. al,* 1995). Among the *Erianthus* germplasm 10 clones are reported to resistant to red rot (Bakshiram *et. al,* 2001). It was involved in the failure of important commercial varieties in different states of the country are removed for cultivation to red rot disease (Viswanathan and Rao, 2007). Recurrent outbreaks of red rot in epidemic forms resulted in the replacement of old varieties regularly and need to develop new resistant varieties. Sugarcane breeding and selection process gave emphasis to adaptability; yield, quality improvement and disease resistant especially red rot resistant varieties.

4. Conclusion

The present study demonstrated the prospects of inheritance of red rot resistance; exact mechanism governing red rot resistance in sugarcane has not been understood. However, two kinds of resistance *viz*., the structural or mechanical that is static and the physiological or biochemical, which is dynamic, play a part in the defenses of the plant against the pathogen. Considering the above facts, the current study aimed to emphasis on the recent finding on physiological resistance that 1856 clones were utilize further studies in the breeding programme for next generation.

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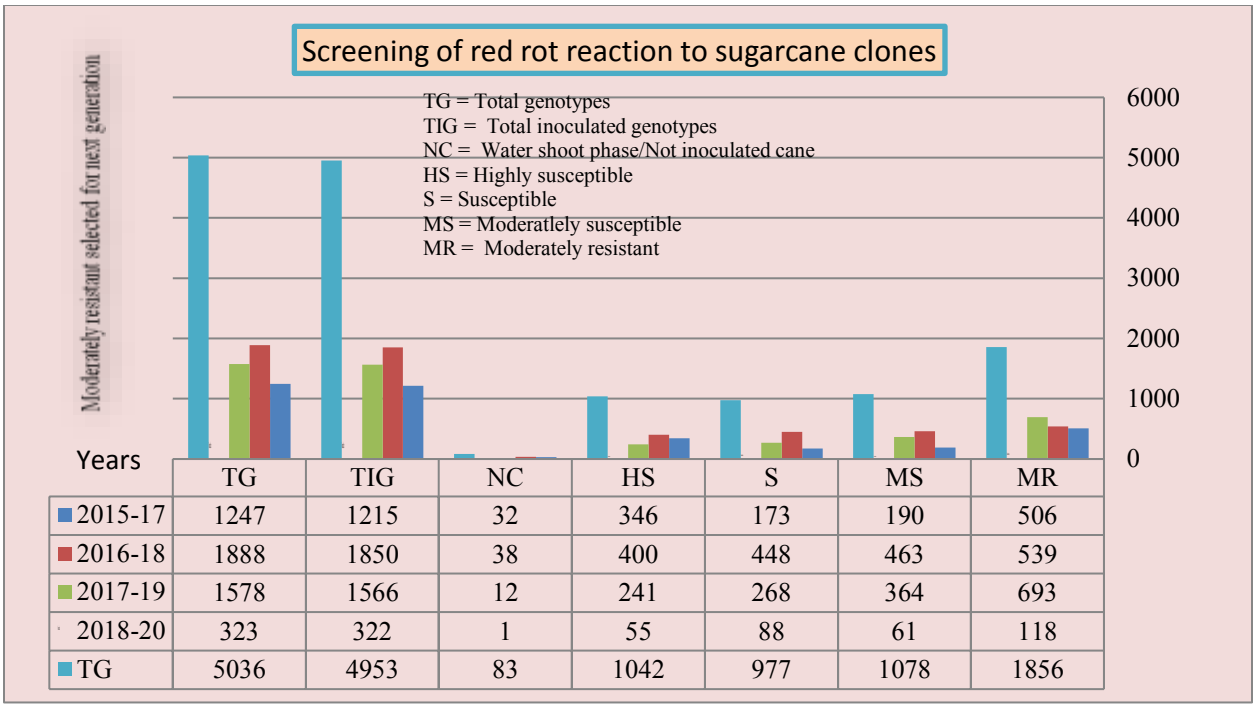

Years	TG	TIG	NC	HS	S	MS	MR
2015-17	1247	1215	32	346	173	190	506
2016-18	1888	1850	38	400	448	463	539
2017-19	1578	1566	12	241	268	364	693
2018-20	323	322	1	55	88	61	118
TG	5036	4953	83	1042	977	1078	1856

Fig. 1: Behaviors of various genotypes in C_1 generation against red rot of autumn planted at Seorahi during- 2015 -17 to 2018-20