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Evaluation of progenies for resistance against red rot in sugarcane (*Saccharum sp.* hybrids)

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ABSTRACT

A field experiment was conducted to find out the red rot resistance clones from 18 crosses of Fý population of *Saccharum sp.* hybrids. The progenies of Fý population were subjected for screening against most virulent and prevalent race (s) of red rot. Fourteen crosses with one or both the parent's resistance to red rot produced predominantly resistant progenies ranging from 25.0 – 63.29 %. Remaining four crosses involving susceptible parents viz CoSe 95422 GC, CoLk 8102 x Co86002, CoLk 8102 x Co 62198 and Co 1148 Self contributed 7.69 - 28.57 % resistant progenies. The transgressive segregants can also be used as potential genetic stocks in red rot resistance breeding programmes

Keywords: *Saccharum sp.* hybrids, red rot resistance, progenies, screening

Red rot, a seed cane transmissible fungal disease, is one of the oldest diseases in sugarcane. This disease caused by *Colletotrichum falcatum* has been reported to occur in many of the sugarcane growing countries. In India, it occurs in serious levels especially in northern belt. Several epiphytotic of red rot have occurred in the past resulting in failure of many varieties in India (Duttamajumder 2008). Red rot causes reduction in cane weight, juice extract and reduces the expected sugar recovery at different infection levels. Effective and economic plant protection methods for control of this disease are not available. Chemical and biological methods are not very effective. As a result, varietal resistance is the only way and means of red rot management and thus breeding for red rot resistance has become the most important aspect in sugarcane breeding programme. The scarcity of resistance in the current breeding population indicates a need to identify new sources of resistance.

In general, the initial stages of selection of progenies are based on red rot resistance, sugar, yield and quality. Elimination of the progenies in initial stage related to red rot is very essential. Hence, the present study was taken up with the objectives to identify red rot resistance clones in *Saccharum* species which might be utilized as red rot resistance genetic stocks in future breeding programmes to develop resistant cultivars.

MATERIALS AND METHODS

Nine hundred and ninety eight progenies comprising of bi-parental, self and general crosses (GC) were subjected to red rot screening. These crosses were CoS 96268 x BO 91, ISH1 x CoSe 96436, CoC 671 x ISH 147, CoLk 8002 x Co 62198, Co 1148 x BO91, BO91 x Co62198, Co85002 x ISH 147, Co 1148 x ISH 150, CoSe 95422 GC, CoLk 8102 x Co 86002, CoLk 8102 x Co 62198, ISH 150 self, Co 1148 Self, CoPant 97222 GC , Co 89003 GC , CoLk 8002 GC , Co 1158 GC and BO 91 GC . These crosses were attempted during flowering season at National Hybridization Garden, Sugarcane Breeding Institute, Coimbatore in 2010-11 and 2011-12. Fluffs were raised at Indian Institute of Sugarcane Research, Lucknow. Seedling progenies of these crosses were transplanted for screening against red rot. Twenty five canes of each progenies were inoculated with the spore suspension of *C. falcatum* (10^6 / ml) in 3rd and 4th internodes (above the ground level) by plug method. Observation on the disease development was recorded by splitting the canes. Data were recorded in respect to nature of tops (green or yellow), lesion width, and nature of white spots and extent of nodal transgression by the pathogen. The disease reaction of these varieties was assessed on the basis of disease index 0-9 scale (Srinivasan and Bhat, 1961). The clones were rated as resistance (R), moderately resistance (MR), moderately susceptible (MS), susceptible (S), highly susceptible (HS) .The mean of total score of 25 canes was taken to assign the grade.

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RESULTS AND DISCUSSION

A total of 998 progenies comprised from 10 bi-parental, 02 self and 06 general crosses involving parent with moderately resistant/resistant (MR/R) x resistant (R), moderately susceptible/susceptible (S/MS) x moderately resistant/resistant (MR/R) and susceptible (S) x susceptible (S), were subjected to red rot screening. The clonal progenies screened against red rot varied in disease reactions in all the 18 crosses (R x

R=7; R x S=7; and S x S =4), from 15 progenies in the cross CoLk 8002 GC to 241 progenies in the cross Co85002 x ISH 147. Crosses involving parent with moderately resistant/ resistant (MR/R) x resistant (R) viz CoPt 97222 GC, Co 89003 GC, CoLk 8002 GC, Co 1158 GC, BO 91 GC, CoS 96268 x BO 91 and ISH 150 Self, produced maximum resistant seedlings ranging from 25.0 – 63.29 percentage (Table 1). The cross ISH 150 Self (MR), produced maximum resistant (63.29%) seedlings i.e. out of 79 progenies tested 50 showed resistant and remaining 29 (11 MS and 18 S/HS) were categorized as susceptible. Crosses i.e., ISH 1 x CoSe 96436, CoC 671 x ISH 147, CoLk 8002 x Co 62198, Co 1148 x BO 91, BO 91 x Co 62198, Co 85002 x ISH 147 and Co 1148 x ISH 150, in which parents are having susceptible (S) x moderately resistant/resistant (MR/R), the resistant progenies varied 11.2-37.5 %. In cross Co 1148 x BO 91, 15 out of 24 progenies and in cross Co 85002 x ISH 147, 214 out of 241 progenies were found to be susceptible i.e., 62.5% and 88.7% respectively. Crosses Co 1148 x BO 91 and CoLk 8002 x Co 62198 produced maximum resistant progenies i.e 37.5 and 31.5 percent, respectively. In the last combination of cross in which both the parents were susceptible, the percentage of resistant progenies in all the four crosses viz., CoSe 95422 GC, CoLk 8102 x Co 86002, CoLk 8102 x Co 62198 and Co 1148 Self were 7.69 - 28.57 %. In cross Co 1148 Self, 24 out of 26 progenies were found to be susceptible 92.3 % and the three crosses CoSe 95422 GC , CoLk 8102 x Co 86002 and CoLk 8102 x Co 62198 the resistant progenies were 20.51, 25.0 and 28.57 % respectively.

Seven crosses viz., Co Pant 97222 GC ,Co 89003 GC, CoLk 8002 GC, Co 1158 GC, BO 91 GC, CoS 96268 x BO 91, ISH 150 self produced predominantly resistant progenies ranging from 25.0 – 63.29 % showing higher range with respect to red rot resistance. The parents involved in these cross combinations are moderately resistant/ resistant to red rot and could be possible source of resistance. In crosses i.e. , ISH 1 x CoSe 96436, CoC 671 x ISH 147 , CoLk 8002 x Co 62198, Co 1148 x BO 91, BO 91 x Co 62198, Co 85002 x ISH 147, Co 1148 x ISH 150, in which one of the parents resistant showed high proportion of resistant progenies. The results from the progeny populations indicated that utilization of the red rot resistant sources in crossing would increase the frequency of red rot resistance in the population.

In the present study, crosses involving susceptible parents viz., Co 1148 Self, CoSe 95422 GC, CoLk 8102 x Co 86002 and CoLk 8102 x Co 62198 produced resistant progenies were 7.69, 20.51, 25.0 and 28.57 % respectively. Study indicated that even when both susceptible parents used, large number of progenies resistance to red rot were obtained. But possibility of getting more resistant progenies is higher, when one or the either of the parent is resistant. Such transgressive segregants are the products of additive gene action and are bound to show stable resistance (horizontal resistance) as suggested earlier by Natarajan *et al***.** 2001b. The transgressed segregates that have arisen from the susceptible parents on either side can also be used as potential genetic stocks in resistance breeding programmes for imparting race non- specific resistance.

The results from the present study suggest that the utilization of identified resistance sources as donors in crossing would increase the frequency of red rot resistance in the progeny for making effective selection and development of red rot resistant varieties in sugarcane. The paucity of resistance in the current

Table 1 Red rot resistance scores of sugarcane progenies

Crosses	HS / S	MS	MR	R	Total	% Resistant
CoS 96268 (R) x BO 91 (R)	4	8	3	1	16	25.0
ISH 150 Self (MR)	18	11	42	8	79	63.29
Co 1148 Self (S)	14	10	02	0	26	7.69
CoC 671(S) x ISH 147 (MR)	36	06	14	0	56	25.0
CoLk 8002(MR) x Co 62198 (S)	22	04	12	0	38	31.5
Co 1148 (S) x BO 91 (R/MR)	13	2	09	0	24	37.5
BO 91(R/MR) x Co 62198 (S)	65	45	28	0	138	20.28
Co 85002 (S) x ISH 147(MR)	159	55	27	0	241	11.20
Co 1148(S) x ISH 150 (MR)	20	22	11	0	53	20.75
ISH 1(R) x CoSe 96436 (MS)	50	20	18	4	92	23.9
CoLk 8102(S/MS) x Co 86002 (S)	05	07	04	0	16	25.0
CoLk 8102 (S/MS) x Co 62198 (S)	19	1	08	0	28	28.57
CoPant 97222 GC (MR)	22	2	9	0	33	27.27
Co 89003 GC (R/MR)	10	2	8	2	22	45.0
CoLk 8002 GC (MR)	3	6	4	2	15	40.0
Co 1158 GC (R)	02	10	05	0	17	29.4
BO 91GC (R/MR)	34	10	17	4	65	32.3
CoSe 95422GC (MR)	16	15	08	0	39	20.51

R-Resistance, MR-Moderately Resistance, MS-Moderately Susceptible, S- Susceptible.

breeding population indicates the need to identify new sources of resistance. The introduction of new *S. spontaneous* clones will thus increase the probability of producing varieties with stable resistance (Natarajan *et al.* 2001b). The results indicate that level of red rot resistance in the population can be increased by careful choice of parent clones and cross- based selection. The genetic stocks developed from this study can be exploited for developing red rot stable resistant clones.

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