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FIELD ASSESSMENT OF PROMISING SUGARCANE GERMPLASM AGAINST WHIP SMUT DISEASE UNDER ARTIFICIAL INOCULATED CONDITION

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Abstract– Twenty four promising sugarcane germplasm of different maturity groups along with checks were screened against whip smut disease under artificial condition during season 2020-21 to identify sources of disease resistance at Central Sugarcane Research Station, Padegaon Maharashtra. Fourteen germplasm designated *viz.*, Co PDN 19004, Co PDN 19007, Co PDN 19011, Co PDN 19016, Co PDN 19017, Co PDN 19025, Co PDN 19028, Co PDN 19041, Co PDN 19042, PDN 15012, CoM 11082, MS 10001, Co 86032 and CoM 0265 showed resistant reaction to smut disease while 10 genotypes exhibited moderately resistant reaction to smut disease under artificially inoculated conditions in the field. Susceptible checks Co 740 had susceptible reaction indicated much disease pressure with susceptible reaction. This resistant germplasm may be further utilized as donor for further breeding programs to evolve new resistant variety against whip smut of sugarcane.

INTRODUCTION

Sugarcane (*Saccharum officinarum*) family Gramineae (Poaceae) is a highly industrious and second largest commercial cash crop in Maharashtra and is the main source for sugar and bioethanol production. In Maharashtra cane area has gone up by about 11% in 2021-22, from 11.48 lakh hectares in 2020-21 to 12.75 lakh hectares in 2021-22. Estimated sugar production, expected to be around 121.28 lakh tons in 2021-22, without diversion into ethanol (Anonymous, 2021). Sugarcane suffers from a multitude of diseases induced by different by fungi, viruses, bacteria and phytoplasma. Sugarcane smut, caused by *Sporisorium scitamineum*, is one of the most severe fungal diseases affecting sugarcane production. In India, it was first reported by Butler (1906) and subsequently by Sydow (1924) and Mundkar (1939). The disease always occurs in Tamil Nadu, Karnataka and Maharashtra states (Alexander, 1975). The whip smut disease causes yield loss to the tune of 39-56% in planted crop and 52-73% in ratoon crop of sugarcane (Mohan and Praksam, 1956). Smut incidence reduces the height and girth of the cane, tillering ability of the plant, cane tonnage, total solids and sucrose content in cane juice and ratio of sugars to fiber making sugar extraction difficult (Xiupeng *et al*., 2019). Primary infection takes place either by soil-borne teliospores or planting infected setts, while secondary infection occurs through airborne fungal spores infecting standing healthy crop (Hoy *et al*., 1991). Reliable, cost effective and eco-friendly disease control can only be achieved through resistant varieties. Cultivation of resistant varieties is the only reliable and practicable control measure to minimize the adverse impact of whip smut disease. Therefore, screening of sugarcane germplasm for smut resistance and other desirable characters is an ongoing process (Rajput *et al*., 2021, Scortecci *et al*., 2012; Sundar *et al*., 2012). Hence a total of twenty four promising sugarcane genotypes included in the initial and advanced varietal trials were assessed for their reaction to the smut disease by artificial inoculation in the field at Central Sugarcane Research Station, Padegaon with a view to find out the sources of resistance for their further exploitation in breeding programme for smut resistance.

MATERIALS AND METHODS

An experiment was conducted at Central Sugarcane

Research Station, Padegaon to assess the promising sugarcane germplasm to smut under artificial inoculated condition during the crop seasons 2020-21. Nineteen genotypes with five checks were evaluated for their resistance against whip smut disease under artificial inoculated conditions in the field. Teliospores freshly collected from smut susceptible sugarcane varieties served as a source of inoculum. Two eye budded sets of each genotype were artificially inoculated by soaking them for 30 minutes in fresh viable (90 to 95% viability) smut teliospores suspension @ 10 g per 50 lit of water having spore load of 10^6 to 10^8 teliospores ml^{-1} (Shinde *et al*., 1985 and Chirme *et al*., 1998). Such treated sets were planted in moist soil in the field @ 20 setts per row of 6 m length.

The observations on germination were noted at 30 and 45 days after planting and the incidence of smut was recorded at fortnightly interval up to harvest. Smut incidence was calculated as percentage of total clumps infected. Based on the cumulative smut incidence, the genotypes were categorized as per Shah *et al.* (1997) and Anonymous (2020) as follows.

Smut Reaction	Incidence (%)
1. Resistant (R)	0.00
2. Moderately resistant (MR)	0.01 to 10.00
3. Moderately susceptible (MS)	10.01 to 20.00
4. Susceptible (S)	20.01 to 30.0
5. Highly susceptible (HS)	More than 30.00

RESULTS AND DISCUSION

The data presented in Table 1 indicate that, twenty four promising sugarcane germplasm of different maturity groups along with checks were screened against whip smut disease under artificial condition during season 2020-21 to identify sources of disease resistance at Central Sugarcane Research Station, Padegaon Maharashtra. Fourteen germplasm designated *viz*., Co PDN 19004, Co PDN 19007, Co PDN 19011, Co PDN 19016, Co PDN 19017, Co PDN 19025, Co PDN 19028, Co PDN 19041, Co PDN 19042, PDN 15012, CoM 11082, MS 10001, Co 86032 and CoM 0265 showed resistant reaction to smut disease while 10 genotypes exhibited moderately resistant reaction to smut disease under artificially inoculated conditions in the field. Susceptible checks Co 740 had susceptible reaction indicated much disease pressure with susceptible reaction. The reaction to smut disease is one of the selection criteria at the early phase of any hybridization programme. The usual method of identifying resistant clones through inoculation test is still the reliable method (Flores *et al*., 2009). The percentage smut infection increased up to sixth months and showed a decreasing trend towards cane maturity (Mendoza, 1971). The method of artificial inoculation by immersion of cutting in suspension of smut spores of sugarcane was found to be effective to evaluate the resistance against smut in experimental material of sugarcane (Briceno *et al*., 2005).

It is confirmed from the present study that the source of resistant against whip smut is available in sugarcane germplasm and it can be further manipulated as donor through breeding program to evolve new high yielding sugarcane resistant variety against whip smut of sugarcane (Afghan *et al*., 1995; Begum *et al*., 2007; Sabalpara and Vaishnav, 2002 and Ali Khan *et al*., 2009). The resistant germplasm against whip smut of sugarcane plays a key role for evolution of resistant varieties through breeding

Table 1. Response of promoting sugarcane germplasm to *Ustilago scitaminea* Sydow causing whip smut under artificially inoculated conditions

S. N.	Genotype	Smut %	Reaction	S. N.	Genotype	Smut %	Reaction
1	Co PDN 19004	0.00	R	13	Co PDN 19030	2.80	MR
2	Co PDN 19007	0.00	R	14	Co PDN 19032	1.72	MR
3	Co PDN 19010	2.32	MR	15	Co PDN 19037	1.86	MR
4	Co PDN 19011	0.00	R	16	Co PDN 19040	1.43	MR
5	Co PDN 19014	3.93	MR	17	Co PDN 19041	0.00	R
6	Co PDN 19016	0.00	R	18	Co PDN 19042	0.00	R
7	Co PDN 19017	0.00	R	19	Co PDN 18032	4.30	MR
8	Co PDN 19021	1.38	MR	20	PDN 15012 (C)	0.00	R
9	Co PDN 19023	1.40	MR	21	CoM 11082 (C)	0.00	R
10	Co PDN 19024	4.12	MR	22	MS 10001(C)	0.00	R
11	Co PDN 19025	0.00	R	23	Co 86032	0.00	R
12	Co PDN 19028	0.00	R	24	Co 740	28.47	S

programme (Begum *et al*., 2007). Varma *et al*. 2020 revealed that only one genotype, 2015A 222 was found moderately resistant to *S. scitamineum* with disease incidence less than 10 per cent and rest of the genotypes recorded disease incidence over 10 per cent.

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