



## Assessment of Resistance to Red rot (*Colletotrichum falcatum* Went) Disease by Different Methods of Inoculation in Sugarcane Germplasm

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### Abstract

Sugarcane genotypes were screened for their resistance to red rot pathogen (*Colletotrichum falcatum* Went.) at the Sugarcane and Rice Research Station, Rudrur consecutively for three years i.e., from 2003-2006. Out of fifty five early and midlate genotypes, twenty six were found moderately resistant to red rot. Sixteen genotypes were found to be resistant and three were moderately susceptible. Four early and three midlate entries showed susceptible reaction while the 2000 R 551 was found highly susceptible to red rot pathogen.

### 1. Introduction

Sugarcane is one of the major cash crops grown in India. It is a long duration and vegetatively propagated crop. Therefore it attracts a number of pathogens and insects and suffers from nutritional disorders. So far 130 diseases have been reported to occur on sugarcane of which diseases like red rot, wilt, smut, ratoon stunting and top rot cause extensive losses. Red rot caused by *Colletotrichum falcatum* Went, a sett borne transmissible fungal disorder is one the oldest known disease of sugarcane that is mainly responsible for the deterioration and eradication of number of promising cultivars (Agnihotri, 1990). *C. falcatum* has been reported to have many physiological races. For this reason, a variety having resistant or moderately resistance to red rot diseases becomes susceptible after few years. There are no satisfactory chemical or physical control measures available that can control this disease efficiently. Breeding for disease resistance has become the main procedure to combat the red rot menace (Duttamajumder and Singh, 1999). An investigation was carried out with few genotypes for their reaction against red rot pathogen by both plug and nodal method of inoculation.

### 2. Materials and Methods

The field experiment was conducted at Regional Sugarcane

and Rice Research Station, Rudrur, Andhra Pradesh, India during 2003-2006 for three consecutive seasons.

Srinivasan and Bhat (1961) demonstrated the use of top drying, lesion length and breadth, nodal transgression and occurrence of transverse white spots in the infected cane to assess the degree of resistance or susceptibility. On this basis, Indian Institute of Sugarcane Research, Lucknow has devised 0-9 scale grading system for evaluation of resistance or susceptibility to red rot. The genotypes were planted in two separate strips for conducting nodal and plug methods of inoculation separately. In a strip each variety was planted in the six meter row length with recommended fertilizer dose 250-100-60 N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O kg ha<sup>-1</sup>. Twenty five canes of each clone were inoculated with the isolate of the pathogen *C. falcatum* derived from cultivar Coc 675 by applying both nodal and plug method of inoculation (Chona, 1954).

#### 2.1. Nodal method of inoculation

In the nodal method, the isolates of *C. falcatum* was mass multiplied in oat agar media separately and a mixed pore suspension was prepared @ 10<sup>6</sup> ml<sup>-1</sup> from 7 day old culture. One ml of spore suspension was injected with a large syringe in each cane into axil of fourth and fifth leaf nodes from the top after slightly pulling leaf sheath without causing any injury. Then inoculated canes were tagged properly in both the methods.



The inoculation was carried out in August that coincided with high humid condition. Observation was recorded 90 days after inoculation. Presence of spindle infection i.e., presence of midrib lesions with or without conidia, presence of acervuli at nodes especially on leaf scars, root primordial or growth rings were taken into consideration for screening the genotypes wherever these lesions were developed, 20 stalks were evaluated by splitting the canes longitudinally and graded according to 0-9 scale.

## 2.2 Plug method of inoculation

In plug method two canes in each of the 25 clumps were inoculated through a plug hole made by a cork borer on the third exposed internode from bottom. (Srinivas and Bhat, 1961) the inoculation were made when 6-7 well formed internodes were developed. Two drops of spore suspension- ( $10^6$  ml<sup>-1</sup>) were put in the hole by a large syringe. The hole was then plugged and sealed with wax. Observation was recorded at 90 days after inoculation. Inoculated canes splitted longitudinally and scored according to 0-9 scale (Shukla et al., 2000). Four different characters was scored as condition of top- green (0) or yellow/dry (1); lesion - very rare (1), restricted spreading (2) covering entire cane (3); white spots - restricted (1) or progressive (2) and nodal transgression - one node (1), two nodes (2) or more (3) nodes crossed. The scores were given to all the evaluated canes and then averaged to get as single score for each genotype and graded in the following scale: upto 2=resistant (R); >2-4= moderately resistant (MR); >4-6= moderately susceptible (MS); >6-8= susceptible (S) and >8 = highly susceptible (HS).

## 3. Results and Discussion

Out of 55 sugarcane clones tested for the red rot light race isolate Coc 671, test entries (Table 1) Co 86032, Co M 95 S 16, Co JN 94-8, Co 99014, Co 99012, Co M 96002, Co 2000-06, Co 2000-09, Co 2000-11, 97 R 123, 97 R 129, 2000 R 131, 2000 R 554, 2000 R 642 2000 R 513, Co 2001-02, Co 2001-06 exhibited resistant reaction except Co 2000-03, which showed a moderate resistant reaction of 2.3 in nodal method of inoculation and susceptible reaction with score of 6.3 and 2000 R 551 with moderately susceptible reaction with score of 5.8 in nodal method and highly susceptible reaction of 8.6 in plug method of inoculation. Clone Co 99010 was moderately susceptible (Score 6.3) in nodal method and susceptible in plug method (score 7.5).

Mid late entries viz., Co 91008, Co 99004, Co 95010, Co M 95020, Co 99008, Co Vc 93120, Co 98013, Co 2000-02, Co 2000-03, Co 2000-02, Co 2000-03, Co 2000-10, Co 2000-13,

Co 2000-15, 97 R 6, 2000 R 992, 2000 R 784, Co TL 1358, 2000 R 463, 2000 R 557, 2000 R 938, 2000 R 854, 2000 R 560, 2000 R 944, 2000 R 860, 2000 R 803, Co TL 1153, Co JN 96-4, Co 2000-15, Co 2001-08 reacted as moderately resistant in nodal method of inoculation out of which Co 99004, Co M 95020, Co Vc 93120, Co 98013, Co 95010, Co 99008, Co 2000-02, Co 2000-03, Co 2000-07, Co 2000-08, Co 2000-10, Co 2000-15, Co TL 1358, 97 R 6, 2000 R 992, 2000 R 557, 2000 R 784, 2000 R 463, 2000 R 557, 2000 R 938, 2000 R 854, Co 2001-08 and Co 2001-944 were found to be moderately resistant where as zonal check Co 6304 showed a moderately susceptible reaction. Co 91008 exhibited moderately resistant reaction by nodal method and susceptible reaction with 7.8 score by plug method. Other genotypes viz., Co M 95 S 16, Co JN 94-8, Co 99014, Co 99012, Co M 96002, Co 2000-06, Co 2000-09, Co 2000-13, 97 R 123, 97 R 129, 97 R 401, 2000 R 131, 2000 R 554, 2000 R 642, 2000 R 513, Co 2001-06 Co 2000-11, Co 2001-09 exhibited moderately resistant reaction. Others were either susceptible or highly susceptible or resistant. 97 R 129 was clearly resistant (score 2) in plug method. Other varieties were resistant in their reaction with score ranging from 1.5 - 3.0. In both type of inoculation, sixteen clones were found to be resistant. The infection was restricted with in the inoculated internode around the point of plug hole in these varieties. Zonal checks cvs. Co 419 and Coc 671 exhibited susceptible highly susceptible reaction with scores 7.3 and 8.7 respectively in plug method. Local selection 2000 R 551 exhibited highly susceptible reaction. 97 R 129 clone behaved in resistant reaction was identified as a promising early mid clone for the zone with higher cane yield and sucrose content with high level performance in farmers fields (Mukunda Rao et al. (2004). 97 R 401 showed resistant reaction with a single cane weight of 1-1.5 kg of high tonnage with high level performs in farmers fields.

In nodal method, the inoculum is put in the nodal region without any injury and the pathogen is subjected to climatic adversities and this may not cause enough infection as in case of plug method. Varieties showing highly susceptible and susceptible reactions in plug method (Table 1) had shown some level of infection by nodal method. Moreover, there were distinct symptom like reddening of internal tissue, spreading of the lesion laterally and longitudinally and presence of white transverse bands in plug method of inoculation which was clear diagnostic feature for grading resistant or susceptible clones. Kalaimani (2002), Shukla et al. (2002) reported similar results. It is suggested that variation or genotypes of Sugarcane that come under moderately resistant or resistant group in plug method could well be exploited as a suitable donor of resistance against *c. falcatum*.

Table 1. Classification of sugarcane genotypes based on their reaction to red rot pathogen category and disease grade

Geno- types	Clone	Nodal grade	Score	Plug method	Score
1	Co 86032	R	0.6	S	6.5
2	Co 99010	MS	6.3	S	7.5
3	Co 99004	R	1.0	MR	2
4	Co M 95 S 16	R	0	R	2
5	Co JN 94-8	R	1	R	2
6	Co M 95020	R	0	MR	2.7
7	Co Vc 93120	R	0	MR	2.4
8	Co 99014	R	0	R	2
9	Co 99008	R	0	MR	2.8
10	Co 91008	MR	2.2	S	7.8
11	Co 98013	R	0	MR	3.1
12	Co 99012	R	0	R	2
13	Co M 96002	R	0	R	2
14	Co 95010	R	1 R	MR	3.6
15	Co 2000-02	R	0	MR	3.4
16	Co 2000-03	MR	2.3	S	6.3
17	Co 2000-06	R	0	R	2.0
18	Co 2000-07	R	0	MR	3.4
19	Co 2000-08	R	1	MR	3.6
20	Co 2000-09	R	0	R	2.3
21	Co 2000-10	R	1	MR	2.8
22	Co 2000-13	R	0	R	1.8
23	Co 2000-15	R	1	MR	3.0
24	Co TL 1358	R	0	MR	3.2
25	96 R 11	R	2	MS	4.1
26	97 R 6	R	0	MR	2.9
27	97 R 123	R	0	R	1.5
28	97 R 129	R	0	R	2
29	97 R 401	R	0	R	1.7
30	2000 R 131	R	0	R	1.8
31	2000 R 554	R	0	R	2
32	2000 R 642	R	0	R	2
33	2000 R 638	R	0	MS	5.9
34	2000 R 784	R	0	MR	3.2
35	2000 R 992	R	0	MR	2.9
36	2000 R 557	R	0	MR	3.8
37	2000 R 556	R	0	MS	5
38	2000 R 463	R	0	MR	3
39	2000 R 938	R	0	MR	3.2

40	2000 R 513	R	0	R	2.0
41	2000 R 854	R	0	MR	3
42	2000 R 551	MS	5.8	HS	8.6
43	2000 R 560	R	0	MR	3
44	2000 R 803	R	0	MR	3
45	Co 2000-860	R	0	MR	4.2
46	Co 2001-02	R	1	R	2
47	Co 2001-09	R	0	MR	4
48	Co 2001-06	R	1	R	3
49	Co 2000-11	R	0	R	3
50	Co 2001-09	R	0	R	2.3
51	Co 2001-08	R	0	MR	3
52	Co 2001-944	R	0	MR	4.4
53	Co 419	MR	2.3	S	7.3
54	Co 6304	S	5.4	S	5.8
55	Coc 671	HS	8.0	HS	8.7

#### 4. Conclusion

Co 91008 exhibited moderately resistant reaction by nodal method and susceptible reaction with 7.8 score by plug method. Others were either susceptible or highly susceptible or resistant. 97 R 129 was clearly resistant (score 2) in plug method. 97 R 129 clone behaved in resistant reaction was identified as a promising early mid clone for the zone with higher cane yield and sucrose content with high level performance in farmers fields. Varieties that were highly susceptible and susceptible reactions in plug method (Table 1) had shown some level of infection in the nodal method. Moreover, there were distinct symptom like reddening of internal tissue, spreading of the lesion laterally and longitudinally and presence of white transverse bands in plug method of inoculation which was clear diagnostic feature for grading resistant or susceptible clones.

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