

SMUT SPORE GERMINATION ON SUGARCANE INTERNODE SURFACES

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Abstract

Data for germination of smut spores on internode surfaces of 40 sugarcane varieties are presented, and they support the hypothesis that resistance to the disease is governed by a chemical resistance mechanism rather than a morphological one. The possibility of using a technique described in the paper as a method for rapid determination of varietal susceptibility to smut is discussed.

Introduction

Various artificial inoculation techniques have been used for the assessment of varietal resistance to smut. Bock,² Waller,¹⁰ and Early³ used spray techniques in which bud surfaces of varieties under test were sprayed with suspensions of fresh smut spores (>10⁶/ml). Injection of spore suspensions into buds using a hypodermic syringe (Anon¹), or smearing buds, which had previously been needle-pricked, with a paste of smut spores (Leu and Teng⁷), have also been tried. Sandhu and Mann,⁸ and Srinivasan⁹ have used techniques in which setts of varieties under test were dipped into spore suspensions. However, as it was noted that the spray inoculation technique could give anomalous estimations of susceptibility in the case of certain varieties, James⁵ concluded that natural infection techniques gave a much more dependable assessment of resistance to smut. All these techniques

take time (between 8-12 months), the evaluation of varieties by natural exposure being the longest. Therefore, in order to facilitate a more rapid determination of varietal resistance, the following technique was developed.

Materials and Methods

Using an 'Aerograph' air brush, the 6th internodes of 40 varieties of sugarcane were sprayed with a suspension of fresh smut spores (circa 10⁶/ml glass distilled water + 100 ppm 'Tween 80'), until discrete droplets formed. The internodes were then placed on damp filter paper in containers, and incubated for six hours at 31°C. At the end of the incubation period the internode surfaces were allowed to dry prior to being sprayed with acetone. Small pieces of polythene (0,03 mm in thickness) were then immediately placed over the sprayed areas, and the acetone was allowed to evaporate. After 10 minutes the polythene films were peeled from the internode surfaces, mounted in water and examined under the microscope to assess percentage smut spore germination (between 100 and 200 spores were counted for each replicate). This peel technique picks up approximately 50% of the spores initially sprayed on the internode surface.

Results

The system of resistance rating is in accord with the proposed international resistance scale

TABLE I
Percentage smut spore germination — mean of 10 replicates

Varieties	Percentage— (arc sine transformed data)	Resistance rating	Varieties	Percentage— (arc sine transformed data)	Resistance rating
B 3439	37,85	3	M13-53	35,36	5
B 42231	45,17	8	Mex 54-81	44,57	9
CB 36-14	40,24	7	Mex 55-261	35,80	6
Co 462	28,32	1	Mex 56-476	40,87	9
Co 527	45,52	9	Mex 59-1828	37,38	6
Co 684	33,51	4	N 51-539	44,37	8
Co 775	36,46	5	N 52-219	29,64	1
Co 1001	40,75	1	N 55-805	43,16	9
CoS 109	39,92	4	NCo 310	49,53	9
CP 29-116	35,78	5	NCo 376	49,38	9
CP 36-105	36,93	5	Pindar	35,67	6
CP 43-47	41,75	7	Q 57	49,66	9
CP 48-103	42,30	7	Q 58	37,42	6
Ebene 1-37	36,84	6	Q 63	38,82	6
L 60-25	36,70	5	Q 68	45,58	9
L 61-67	31,06	7	Q 70	32,34	5
M 383-41	37,49	6	Q 80	29,80	1
M 31-45	39,28	1	S 17	27,95	1
M 202-46	33,77	4	Triton	33,48	—
M 428-51	25,61	3	Waya	37,27	—

CV% = 6,86; SE = ± 0,83.
P @ 0,05 = 2,29; P @ 0,01 = 3,01; P @ 0,001 = 3,84.

(Hutchinson⁴), and is related to the population of smut whips per hectare (James⁶). A strong correlation was revealed between the varietal resistance ratings and the percentage smut spore germination on the internode surfaces ($r = + 0,728$; $P = 0,001$).

Discussion

Waller¹¹ presented evidence supporting the view that resistance of varieties was determined by bud morphological characteristics; however, this was not corroborated by James⁵ and Early³. The germination of smut spores in exudates from the outer bud-scales of varieties differing in resistance to the disease (Early³) appears to suggest a chemical resistance mechanism rather than a morphological one. Whilst the data presented above support this hypothesis, the results for Co 1001 and M 31-45 show that the mechanism governing varietal susceptibility to smut is not entirely chemical — specifically as these two varieties are resistant to smut under Rhodesian lowveld conditions. Nevertheless, a continuation of this work with more varieties, and an elucidation of the reasons for the inhibition of smut spore germination, will evaluate the dependability of this technique as a method for quick determination of varietal susceptibility to smut.

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