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GLASSHOUSE SCREENING OF SPECIES OF STYLOSANTHES FOR RESISTANCE TO ANTHRACNOSE DISEASES

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SUMMARY

The resistance to anthracnose of 278 accessions of Stylosanthes species was rated in glasshouse tests with Type A and Type B isolates of Colletotrichum gloeosporioides. With the Type A isolates S. capitata, S. sympodialis and S. guianensis were the most resistant while S. fruticosa and S. subsericea were the most susceptible species. In S. hamata, S. humilis, S. montevidensis, S. scabra and S. viscosa, between 8 and 47% of accessions were resistant to Type A isolates. Only S. guianensis and S. montevidensis were damaged by Type B isolates with 28% of S. guianensis accessions being resistant.

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GLASSHOUSE SCREENING OF SPECIES OF STYLOSANTHES FOR RESISTANCE TO ANTHRACNOSE DISEASES

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INTRODUCTION

Anthracnose diseases caused by Colletotrichum gloeosporioides have severely damaged pastures and seed crops of some Stylosanthes species in northern Australia (Irwin and Cameron 1978). Although chemical control measures may be justified on economic grounds in high value seed crops (Davis 1981), disease control in pastures can only be approached economically by developing resistant cultivars (Lenne et al. 1980), perhaps in conjunction with cheap management practices such as burning (Lenne 1982).

In glasshouse tests some lines of S. guianensis, S. hamata, S. viscosa and S. scabra showed high levels of resistance to Type A and Type B forms of C. gloeosporioides but the stability of this resistance was questioned following the detection of a second Type A race with specialization on S. viscosa CPI 33941 (Irwin and Cameron 1978). Screening of large numbers of accessions was proposed to identify highly

resistant accessions which could be used in future selection programs if further pathogenic specialization was detected in Type A and Type B forms.

In this paper we report the results of glasshouse screening of accessions of Stylosanthes species against Type A and Type B isolates of C. gloeosporioides.

MATERIALS AND METHODS

A total of 278 accessions of Stylosanthes species was tested in two runs with 12 standard accessions included in both runs. The experimental design was a split plot in two replications with isolates as main plots and accessions as subplots.

Sixteen plants of each accession were grown in peat cups (8 cm diameter, 4 seedlings per cup) in a sand/peat/peanut-shell mix (6:3:1) fertilized with the necessary nutrients. In a preliminary test, inclusion of three isolates in the inoculum (either for Type A or Type B) did not obscure the disease reaction of the most pathogenic isolate for each isolate/host combination so composite inocula were used to screen for resistance to Type A and Type B respectively. Isolates 21257[†], 21613 (both race 1, R.D. Davis, J.A.G. Irwin, D.F. Cameron unpublished data) and 21365 (race 2) were used for Type A and 21718, 21719 and 21722 (all race 1, D.F. Cameron, J.A.G. Irwin, R.G. O'Brien unpublished data) for Type B. Individual isolates were prepared by streaking conidia onto Ca^{2+} V-8 agar plates and incubating at 25°C under near ultraviolet light for 10 days. Individual spore suspensions were prepared (c. 1×10^6 spores

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[†] Queensland Department of Primary Industries, Plant Pathology Branch accession numbers.

ml^{-1}) and mixed to give the composite inocula (c. 1×10^6 spores ml^{-1}) for Types A and B respectively. Plants six to eight weeks old were sprayed with a spore suspension until run-off and then boxes of plants were enclosed for 48 h in plastic sheets within a polythene humidity chamber (relative humidity > 85%) in a glasshouse. After removal of the plastic sheets the plants were kept in the chamber for a further eight days. The leaves of each plant were rated for disease severity, 10 days after inoculation, on a 1-10 scale (1 = no visible symptoms, 5 = 10-25% leaf necrosis, 10 = plant death).

RESULTS AND DISCUSSION

A brief summary of the results for seven of the species was published previously (Cameron, O'Brien and Irwin 1980). Type A inoculum produced moderate to severe damage on all species except S. capitata and S. sympodialis, but Type B was damaging to only two species, S. guianensis and S. montevidensis. Comparisons between the two runs for those standard accession/inoculum type combinations causing disease showed that leaf disease ratings were similar ($r = 0.82$, $P < 0.01$) so the results for the two runs were combined. Results for all species for the Type A inoculation are summarised in Table 1, and details of disease reactions for individual accessions are shown in Table 2.

All accessions of S. fruticosa, S. subsericea, S sp. 'aff. hamata', S. angustifolia, S. erecta, S. calcicola and S. sp. were classed as susceptible or highly susceptible to the Type A inoculum. S. fruticosa and S. subsericea would be unlikely to be useful in regions where regular disease epiphytotics are experienced, but larger numbers of accessions of the other species need to be tested to see if resistance can be found. Although some accessions of S. hamata, S. humilis, S. montevidensis, S. scabra and S. viscosa were classed as susceptible or highly susceptible,

there is scope for selection against susceptibility to the Type A inoculum among the accessions of these five species classed as resistant. Almost all of the S. guianensis (97%) and all the S. capitata and S. sympodialis accessions were either resistant or only slightly susceptible to the Type A inoculum.

Results for the inoculation of S. guianensis and S. montevidensis with Type B inoculum are shown in Table 2. Cultivars Schofield and Endeavour were included in the 31% of S. guianensis accessions classed as highly susceptible. Cultivars Graham, Cook and Oxley were in the resistant, slightly susceptible and susceptible groups respectively. There was again reasonable scope for selection for resistance within S. guianensis with 24% of the accessions classed as resistant. None of the four accessions of S. montevidensis was resistant to the Type B inoculum.

Screening of the 278 accessions of Stylosanthes species has confirmed the marked specificity of Type B disease on S. guianensis and the related species S. montevidensis. Lenne and Sonoda (1979) tested 96 accessions of Stylosanthes species against two isolates of C. gloeosporioides, one each from Florida and Australia. These authors considered that their isolates could probably be classified as Type A and the reactions across the 13 species tested are generally consistent with expectation for Type A isolates. Fifteen of the accessions tested by Lenne and Sonoda (1979) were also tested by us and the disease scores of our Type A inoculum on these common accessions were more similar to those for their Australian isolate ($r = 0.54$, $P < 0.05$) than to those for their Florida isolate ($r = 0.32$, $P > 0.05$).

Glasshouse tests for disease resistance provide a rapid means of screening large numbers of accessions against defined isolates of a disease organism. With organisms such as C. gloeosporioides, which show considerable pathogenic variation, repeated screening is necessary as new

variants of the organism are recognised. Further variation in both Type A (Davis et al. 1984 and unpublished data) and Type B (D.F. Cameron, J.A.G. Irwin, R.G. O'Brien unpublished data) isolates of C. gloeosporioides has already been observed in Queensland and much additional variation is already apparent in South America (Lenne et al. 1982, D.F. Cameron and M. Charchar unpublished data). This challenge is being met by further screening of selected resistant accessions against new Australian races of Type A and Type B disease and through introduction of resistant accessions from major screening programs based in Colombia (C.I.A.T.) and Brazil (EMBRAPA/C.I.A.T.).

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Table 1: Summary of disease reactions of *Stylosanthes* species to Type A inoculum of *Colletotrichum gloeosporioides*.

Species	No. accessions screened	No. in disease reaction[1] class HS	S	SS	R	% resistant
S. angustifolia	2	1	1	0	0	0
S. calcicola	1	1	0	0	0	0
S. capitata	8	0	0	1	7	88
S. erecta	3	3	0	0	0	0
S. fruticosa	22	18	4	0	0	0
S. guianensis	61	0	2	17	42	69
S. hamata	55	0	10	19	26	47
S. sp.	2	0	2	0	0	0
S. sp. aff. *hamata*	3	1	2	0	0	0
S. humilis	41	1	11	21	8	20
S. montevidensis	4	0	3	0	1	25
S. scabra	39	1	17	18	3	8
S. subsericea	16	9	7	0	0	0
S. sympodialis	5	0	0	1	4	80
S. viscosa	16	2	4	4	6	38

[1] R (resistant) - Disease rating (DR) ≤ 2; SS (slightly susceptible) - $2<DR<3$; S (susceptible) - $3<DR\leq 5$; HS (highly susceptible) - $DR>5$.

Table 2: Disease reaction of accessions of *Stylosanthes* spp. to Type A inoculum of *Colletotrichum gloeosporioides*.

Species	Accession No.[1] or Cultivar	Disease reaction[2]	Species	Accession No. or Cultivar	Disease reaction	Species	Accession No. or Cultivar	Disease reaction
S. angustifolia	33433	S	*S. fruticosa*	47068	HS	*S. guianensis*	36257	R
"	40236	HS	"	48386	S	"	37204A	R
S. calcicola	36045	HS	"	48387	S	"	37205B	R
S. capitata	40238	R	"	60354	HS	"	37688	R
"	40240A	R	"	60356	HS	"	38222	R
"	40241	R	"	60357	HS	"	38385	R
"	49809A	R	"	75151	HS	"	38391	R
"	55838	SS	"	75152	HS	"	39112	R
"	55840	R	*S. guianensis*	cv. Cook	R	"	39114	R
"	55842	R	"	cv. Endeavour	SS	"	39115	SS
"	55843	R	"	cv. Oxley	R	"	40246	R
S. erecta	34118	HS	"	cv. Schofield	S	"	40255	SS
"	35015	HS	"	Q8442[3]	R	"	40256	R
"	35020	HS	"	9215	R	"	40257	R
S. fruticosa	25368	HS	"	11491	SS	"	40258	R
"	32717	S	"	11492	R	"	40259	R
"	32871	HS	"	11846	R	"	40261	SS
"	40615	HS	"	11849	SS	"	40263	R
"	40764A	HS	"	33034	SS	"	40293	SS
"	41116	HS	"	33479	R	"	40294	R
"	41117	S	"	33501A	R	"	40295	R
"	41219	HS	"	33706B	R	"	40297	SS
"	41220	HS	"	33978	SS	"	40567	R
"	43349	HS	"	34000	S	"	41209	R
"	45174	HS	"	34440	SS	"	41218	SS
"	45175	HS	"	34906	R	"	43206	R
"	45249	HS	"	34912	SS	"	46589A	R
"	47067	HS	"	34915	SS	"	49819	R
			"	34928	R	"	49842B	R

S. guianensis	55806	R
"	55845	R
"	55846	SS
"	55847	R
"	55848	R
"	65358	SS
"	65360	R
"	65957	R
"	67652	SS
"	67653	R
"	68836	R
S. hamata	cv. Verano	SS
"	33205	R
"	33231	S
"	36046	R
"	37037	SS
"	37038	SS
"	38843	R
"	40268	R
"	40275B	R
"	46587	SS
"	46588	S
"	49080	R
"	55802	SS
	55812	SS
"	55820	S
"	55821	S
"	55822	SS
"	55823	SS
"	55824	SS
"	55825	SS
"	55826	SS
"	55827	S
"	55828	S
"	55830	SS
"	55831	S
"	56211	R
"	57248	R
"	61624	S
"	61669	R
"	61670	R
"	61671A	R
"	61671B	SS
"	$61672B_1$	R
"	$61672B_2$	SS
"	62160	R
"	65361	R
"	65363	R
"	65365	S
"	65369	R
"	65370	R
"	65371	SS
"	70358	R
"	70359	R
"	70360	R
"	70361	R
"	70520	R
"	70521	S
"	70522	R
"	70523	R
"	70524	R
"	70525	SS
"	70526	SS
"	70529	R
"	72850	SS
"	72859	SS
S. sp.	34148	S
"	55797	S
S. sp. aff. hamata	55804	HS
"	55813	S
"	55871	S
S. humilis	cv. Paterson	S
"	cv. Lawson	S
"	cv. Gordon	S
"	DC29[4]	HS
"	33830	S
"	33979	SS
"	34116	S
"	34752	SS
"	38753B	SS
"	40269	SS
"	40270	SS
"	40275	R
"	40278	SS
"	46884	S
"	48385	SS
"	49824A	SS
"	49825	R
S. humilis	49826	SS
"	49827A	SS
"	49828A	S
"	52046	R
"	52047	R
"	55809	R
"	55819	SS
"	55849	S
"	55850	SS
"	55851	SS
"	55852	SS
"	55853	SS
"	55854	S
"	57246	S
"	58729	R
"	61667	SS
"	61668	S
"	61672A	SS
"	61674	R
"	62159	SS
"	63463	SS
"	63464	SS
"	65373	R
"	65374	SS
S. montevidensis	11494	R
"	11496	S
"	11847	S
"	53962	S
S. scabra	cv. Fitzroy	S
"	cv. Seca	R
"	Q8240	SS
"	34750	SS
"	34907	SS
"	36260	SS
"	39113	SS
"	40282	S
"	40283	S
"	40284	SS
"	40286	S
"	40287	SS
"	40288	S
"	40289	S
"	40290	R
"	40291	R

Species	Accession No. or Cultivar	Disease reaction	Species	Accession No. or Cultivar	Disease reaction	Species	Accession No. or Cultivar	Disease reaction
S. scabra	40301	S	S. subsericea	Q8435	HS	S. viscosa	33941	HS
"	49306	SS	"	Q8441	S	"	34904	SS
"	49831	SS	"	33940	S	"	38611	S
"	49833	SS	"	33942	S	"	40264B	R
"	49834	HS	"	33943	HS	"	40296	SS
"	52056	SS	"	37274	S	"	40302	R
"	52060	SS	"	38604	HS	"	41212	S
"	55799	S	"	38605	HS	"	50223	S
"	55803	S	"	38609	HS	"	51575	HS
"	55805	S	"	38610	HS	"	55859A	R
"	55811	S	"	41214	HS	"	55859B	R
"	55817	SS	"	41217	HS	"	55862	R
"	55818	SS	"	46586	HS	"	55863	R
"	55857	S	"	50153	S	"	61675	SS
"	55858	S	"	67657	S			
"	55860	SS	"	67658	S			
"	55866	S	S. sympodialis	65958	R			
"	55867	S	"	65959	SS			
"	55868	SS	"	65960	R			
"	55870	SS	"	65961	R			
"	55872	S	"	67703	R			
"	55874	S	S. viscosa	33436	SS			
"	55875	SS	"	33831	S			

[1] Commonwealth Plant Introduction number.
[2] R (resistant)- Disease rating (DR) ≤ 2; SS (slightly susceptible)- $2 < DR \leq 3$; S (susceptible)- $3 < DR \leq 5$; HS (highly susceptible)- $DR > 5$.
[3] Queensland Department of Primary Industries number.
[4] Local collection number.

Table 3: Disease reaction of accessions of Stylosanthes guianensis and S. montevidensis to Type B inoculum of Colletotrichum gloeosporioides.

Species	Accession No.[1] or Cultivar	Disease reaction[2]	Species	Accession No. or Cultivar	Disease reaction	Species	Accession No. or Cultivar	Disease reaction
S. guianensis	cv. Cook	SS	S. guianensis	37688	SS	S. guianensis	49842B	R
"	cv. Endeavour	HS	"	38222	SS	"	55806	R
"	cv. Graham	R	"	38385	HS	"	55845	S
"	cv. Oxley	S	"	38391	HS	"	55846	SS
"	cv. Schofield	HS	"	39112	R	"	55847	HS
"	Q8442[3]	S	"	39114	SS	"	55848	HS
"	9215	SS	"	39115	S	"	65358	S
"	11491	SS	"	40246	SS	"	65360	R
"	11492	SS	"	40255	R	"	65957	S
"	11846	R	"	40256	HS	"	67652	HS
"	11849	R	"	40257	R	"	67653	HS
"	33034	HS	"	40258	S	"	68836	SS
"	33479	HS	"	40259	S	S. montevidensis	11494	HS
"	33501A	R	"	40261	S	"	11496	SS
"	33706B	HS	"	40263	SS	"	11847	S
"	33978	S	"	40293	SS	"	53962	SS
"	34000	R	"	40294	R			
"	34440	HS	"	40295	SS			
"	34906	SS	"	40297	S			
"	34912	R	"	40567	S			
"	34915	S	"	41209	HS			
"	34928	SS	"	41218	HS			
"	36257	R	"	43206	HS			
"	37204A	HS	"	46589A	HS			
"	37205B	HS	"	49819	R			

1 Commonwealth Plant Introduction number.
2 R (resistant)- Disease rating (DR) $\leq$ 2; SS (slightly susceptible)- 2 < DR $\leq$ 3; S (susceptible)- 3 < DR $\leq$ 5; HS (highly susceptible)- DR > 5.
3 Queensland Department of Primary Industries accession.