REACTION OF COMMON CULTIVARS TO THE ASIAN SOYBEAN RUST PATHOGEN, *PHAKOPSORA PACHYRHIZI*, UNDER FIELD CONDITIONS IN SOUTH AFRICA AND BRAZIL

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Introduction

Phakopsora pachyrhizi, the fungus that causes the Asian soybean rust (ASR) disease is unusual for its capacity to infect soybeans (*Glycine max*) and some 95 other leguminous species, including dry and snap beans (*Phaseolus vulgaris*). Many of the reported hosts are from host-range studies conducted in the greenhouse involving artificial inoculations of single cultivars.

ASR was reported occurring in soybeans for the first time in South Africa in 2001 and in Brazil in 2002. Subsequently, ASR has caused devastating epidemics in both countries. ASR was also reported occurring for the first time in the continental US in November 2004. The ASR pathogen has also been recently reported infecting a dry bean cultivar under field conditions in South Africa (du Preez et al, 2005). There are no reports indicating whether *P. pachyrhizi* occurs in other common bean cultivars under field conditions and whether the ASR pathogen can cause major yield losses on dry and snap beans. This is the first report of the reaction of common bean cultivars to the ASR pathogen under field conditions in South Africa and Brazil.

Material and Methods

Due to constraints in international seed movement, only a few common bean cultivars, that had been used extensively in breeding dry and snap beans for resistance to the common bean rust *Uromyces appendiculatus* were selected for evaluation in Brazil and South Africa. In these countries, as well as in some dry bean producing US states, dry beans are often planted in fields adjacent to soybean fields. In Brazil, the trials were planted in Goiania and Rio Verde in the state of Goias. The common bean cultivars were planted in a field in very close proximity to a field of soybeans naturally infected with ASR. Leaves from top, middle and lower parts of the common bean plants were collected and evaluated for ASR severity using a 0-100 % scale. In South Africa, the trial was planted at the Cedara Agricultural Research Station near Pietermaritzburg in KwaZulu-Natal. Soybeans were planted on December 9, 2004. Common beans were planted on January 17, 2005, in two rows left empty between the soybean rows. A 1-9 severity scale was used for severity evaluation where 1 was assigned to plants with no visible ASR symptoms and 9 to plants with very severe symptoms that resulted in severe premature defoliation.

Results and Discussion

The results from South Africa and Brazil were compared here with unpublished results obtained previously under greenhouse conditions in the US (Table 1). The soybeans planted in Brazil developed severe ASR symptoms. In Goiania, the soybeans had 70 % average severity while in Rio Verde the average severity was 60 %. In both locations, the common bean cultivars Aurora, CNC, and PI 181996 had no visible ASR symptoms, while the other cultivars had very mild symptoms.

In South Africa, soybeans had well established ASR symptoms by March 11, while the common bean cultivars only had isolated pustules on the foliage. By April 7, the soybeans were completely defoliated prematurely by the ASR pathogen, while low infection was observed on the lower leaves of most common beans planted adjacent to the heavily infected soybeans. On

April 7, the average infection on leaves of mature common beans plants located 3 to 5 meters from heavily infected soybeans was very mild. The mild ASR symptoms on common beans in South Africa compared to the severe symptoms on soybeans suggest that common beans are much less susceptible to ASR than soybeans. More research needs to be done to confirm these initial results. More importantly, several common bean cultivars, such CNC, Aurora, Early Gallatin and PI 181996 exhibited high levels of resistance to six isolates of the soybean rust pathogen from Taiwan, Thailand, Zimbabwe, Brazil and Paraguay when inoculated under greenhouse conditions in the US (data not shown). These were also the same common bean cultivars that were the most resistant to the ASR pathogen under field conditions in Brazil and South Africa. The results from the greenhouse in the US and field in Brazil and South Africa indicate that some common beans are highly resistant to the ASR pathogen. The gene or genes in common beans that control the resistance to the ASR pathogen can be utilized to develop ASR-resistant common beans through traditional breeding. It may be possible to clone the ASR resistance genes from common bean and express them in soybeans using transgenic methods.

Reference: du Preez, E. D., N. C. van Rij, K. F. Lawrance, M. R. Miles, and R. D. Frederick. 2005. First Report of Soybean Rust Caused by *Phakopsora pachyrhizi* on Dry Beans in South Africa. Plant Dis. 89:206.

TABLE 1. Comparison of the reaction of common beans to the Asian soybean rust pathogen under field conditions in South Africa and Brazil with unpublished results obtained previously under greenhouse conditions in the United States

		USA Greenhouse		South Africa* Cedara		Brazil Goiania	Brazil Rio Verde	
SOYBEANS	R. GENES	Index(1-9)		Index (1-9)		Severity (0-100)		
PI 200492	Rpp1	7.2	S	Local checks		Checks	Checks	
PI 230970	Rpp2	7.6	S	9	VS	70.0	60.0	VS
Ina		8.6	VS					
PI 45925B	Rppr	9.0	VS					
COMMON BEANS Inoculated in the Greenhouse								
CNC	Ur-cnc1, -cnc2	3.9	R/I	4	I	0.0	0.0	R
Early Gallatin	Ur-4	4.7	I Low	6.5?	I?	0.0		
Aurora	Ur-3	5.0	I Low	?(>6)	I or S	0.0	0.0	R
PI 181996	Ur-11	5.4	I Low	4	I	0.0	0.0	R
BelMiNeb-RMR-5	Ur-4, -6, -11	5.4	I Low	4.25	I	0.6	0.0	
BelDak-RR-2	Ur-3, -6, -CNN	5.8	I	6	I/S	0.0	0.5	
BelMiNeb-RMR-7	Ur-3, -4, -11	5.8	I	6	I/S	0.3	0.5	
Pinto 114		5.8	I	?	?	0.6	0.0	
BelMiDak-RMR-10	Ur-4, -11	6.1	I	5.5	I			
BelDakMi-RMR-18	Ur-3, -4, -6, -11	6.1	I	5.5	I	0.6	0.0	
BelDakMi-RMR-14	Ur-3, -6, -11	6.8	I/S	6	I/S			
PI 260418		6.8	I/S	4	I	2	0.0	
BelNeb-RR-1	Ur-5, -6, -7	7.2	S	5	I	0.9		
BelMiNeb-RMR-8	Ur-3, -4, -6, -11	7.2	S	5	I	0.6		
Golden Gate Wax	Ur-6	7.2	S	?(>6)	I or S	0.0	0.5	
Mexico 309	Ur-5	7.9	S	5	I	0.3	0.0	

*South Africa: a "?": other diseases were very severe making evaluation very difficult or impossible.
*South Africa: 0-3 = R; 4-6 = I; 6-6.9 = I/S; 7 = S; 8-9 = VS. Ratings have been taken as an average of the complete canopy (which ranged from 0 to 8 and in others from 6 to 7), taking the amount of defoliation into account.
*South Africa: long-season lines had the advantage of new growth, and in April, the epidemic stood more or less still after the defoliation of the soybeans.