Alternative Hosts to *Phakopsora pachyrhizi*, the Causal Agent of Soybean Rust

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Introduction

Phakopsora pachyrhizi Syd. & P. Syd. is known to have a broad host range. Nearly all of the known hosts belong to the subfamily Papilionoideae within the family Fabaceae. Little is known about whether the legumes in the U.S. could be hosts of *P. pachyrhizi* since they previously have not been associated with the geographically isolated fungus. These alternative hosts could serve as additional inoculum sources and provide additional overwintering sites for the pathogen.

Materials and Methods

In this study, 176 species representing 57 genera of legumes, the majority of which were either native or naturalized to soybean growing areas of the U.S., were tested at the USDA-ARS FDWSRU Plant Pathogen Containment Facility. A total of 264 accessions (between one and three accessions per species) were inoculated with a mixture of four *P. pachyrhizi* isolates collected in 2001 from Brazil, Paraguay, Thailand and Zimbabwe. Plants were rated 14 days later, reinoculated, and rated again 14 days after reinoculation. Reaction type and severity and sporulation data were taken on both dates using a 1-5 scale (1 = no visible symptoms; 5 = fully susceptible).

Results

Of the 176 species inoculated, 105 species in 33 genera were infected. Of the 105 infected, 87 species in 28 genera were previously unreported as hosts. Of these, 14 new genera are reported. Forty-eight new host species had visible sporulation with a range from 1.1 to 5 and mean severities ranging from 1.3 to 4; only four had a tan reaction (Table 1). The rust reaction on sporulating host species was variable (Figure 1).

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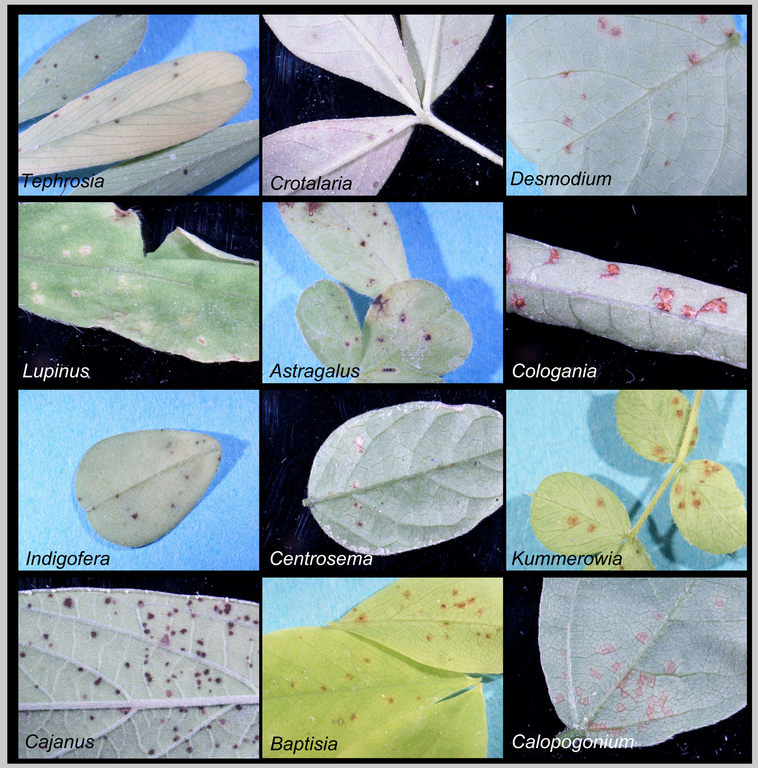
Table 1. New hosts to *P. pachyrhizi* with visible sporulation.

Scientific Name	# Acc[1]	N[2]	Mean severity	SD[3]	Mean sporulation	SD[3]
Astragalus cicer	3	8	3.1	0.6	1.5	1.1
Astragalus glycyphyllos	3	5	1.6	0.5	1.2	0.4
Baptisia alba var. macrophylla	2	5	2.0	1.0	1.2	0.4
Baptisia bracteata var. laevicaulis	1	3	2.3	1.2	1.3	0.6
Calopogonium caeruleum[4]	1	3	4.0	1.0	2.0	1.0
Caragana arborescens	5	13	1.7	0.6	2.1	1.7
Centrosema virginianum	3	4	1.8	1.5	1.8	1.5
Cologania angustifolia var. angustifolia	2	6	4.0	0.9	3.5	1.2
Cologania angustifolia var. stricta	2	6	2.7	0.5	2.2	0.8
Cologania lemmonii	1	1	4.0	.	4.0	.
Crotalaria incana[4]	3	7	2.0	0.8	2.6	2.0
Crotalaria lanceolata[4]	3	3	1.7	1.2	2.3	2.3
Crotalaria ochroleuca	3	7	1.7	0.8	1.1	0.4
Crotalaria sagittalis	1	3	1.7	0.6	1.3	0.6
Crotalaria verrucosa	1	3	2.3	0.6	1.7	1.2
Desmodium cuspidatum	1	2	2.0	0.0	3.0	2.8
Desmodium obtusum	1	3	2.7	1.2	1.7	0.6
Desmodium perplexum	1	3	2.3	0.6	2.7	2.1
Glycine max[4]	2	6	3.7	1.0	3.7	1.4
Glycyrrhiza lepidota	3	9	2.8	0.7	1.2	0.4
Indigofera spicata	3	5	1.8	0.8	1.2	0.4
Indigofera suffruticosa	2	5	2.0	1.0	1.2	0.4
Kummerowia stipulacea	3	9	3.0	1.0	1.3	0.7
Lathyrus aphaca	3	7	2.3	1.3	2.7	1.7
Lespedeza capitata	3	9	3.1	0.9	1.1	0.3
Lespedeza cuneata	3	9	2.3	0.5	1.3	0.5
Lespedeza cyrtobotrya	3	8	2.3	0.7	1.4	0.5
Lespedeza thunbergii	2	5	1.6	0.5	1.4	0.9
Lotus pedunculatus	1	3	1.7	1.2	1.3	0.6
Lupinus perennis	1	1	2.0	.	5.0	.
Lupinus texensis	1	2	3.0	1.4	1.5	0.7
Medicago laciniata	3	9	1.3	0.7	1.1	0.3
Medicago lupulina	3	8	1.4	0.5	1.5	1.4
Medicago orbicularis	5	15	2.4	0.8	1.5	1.1
Medicago sativa ssp. falcata	3	9	1.3	0.5	1.3	1.0
Pseudovigna argentea[4]	1	2	4.0	1.4	2.5	0.7
Robinia viscosa var. hartwegii	1	3	2.3	0.6	1.3	0.6
Senna sophera	1	3	2.3	0.6	1.3	0.6
Tephrosia cinerea	1	1	3.0	.	3.0	.
Tephrosia purpurea	5	7	2.9	0.4	1.6	0.5
Teramnus labialis	5	10	2.5	1.0	1.5	1.3
Teramnus micans	1	2	2.0	0.0	1.5	0.7
Teramnus uncinatus	4	12	2.4	0.7	1.1	0.3
Trifolium aureum	1	3	1.3	0.6	1.3	0.6
Trifolium cernuum	1	3	2.7	0.6	2.0	1.7
Trifolium lappaceum	3	8	1.6	0.7	1.1	0.4
Trifolium spumosum	1	2	3.0	0.0	1.5	0.7
Vigna adenantha	2	5	2.0	1.0	2.6	2.2
Vigna luteola	3	9	3.3	0.5	2.1	1.1

[1]Number of accessions; [2]Number of plants; [3]Standard deviation; [4]Indicates a tan reaction type

Figure 1. Lesions of *P. pachyrhizi* on various hosts at 1X magnification.



Conclusions

The fungus did not sporulate on all hosts with *P. pachyrhizi* infection. The sporulation and severity ratings may help in predicting the general suceptibility of a host, but it is important to recognize that greenhouse conditions in the Ft. Detrick containment facility were controlled. The legumes tested are native to areas with diverse climates and microclimates ranging from the subtropical Florida Keys to the temperate Midwest. The infection potential of nonsporulating hosts in the greenhouse experiment should still be considered because of the critical role of environmental conditions in dictating the behavior of the fungus. The various habitats for these plants throughout the U.S. could result in altered infectivity, severity, and sporulation to what was observed in the greenhouse.