Mycoparasitism of *Phakopsora pachyrhizi* by *Simplicillium lanosoniveum*

N.A. Ward, R.W. Schneider, M. Brown
Department of Plant Pathology, Louisiana State University AgCenter, Baton Rouge, LA 70803

**Summary:**
The purpose of this study was to document mycoparasitism of urediniospores of *Phakopsora pachyrhizi* by *Simplicillium lanosoniveum*, a filamentous fungal inhabitant of rust sori. Early in the project, we determined that the antagonist reduced the total number of rust sori on soybean leaf surfaces and that infected sori produced a larger proportion of brown urediniospores that failed to germinate.

Scanning electron microscope observations not only showed that *S. lanosoniveum* exhibited a trophic response to sori, but also showed numerous colonized sori and hyphae wrapped around urediniospores. These hyphae were not observed apart from sori.

Fluorescence microscopy showed hyphae of *S. lanosoniveum* coiled within and around urediniospores, confirming the mycoparasitic interaction between the antagonist and the pathogen.

**Objective:**
The objective of this study was to evaluate the mode of interaction between *P. pachyrhizi* and *S. lanosoniveum* through various microscopic techniques.

**Introduction:**
*Simplicillium lanosoniveum* was identified as an inhabitant of soybean rust sori. Isolates were readily collected from rust-infected soybean leaves in 2007, but since then, no other isolates have been detected. In *in vivo* and *in planta* experiments, the fungus did not colonize noninfected leaf surfaces. In the presence of soybean rust, however, *S. lanosoniveum* aggressively colonized sori and sporulated within 3 or 4 days. Detached leaf experiments determined that *S. lanosoniveum* reduced the total number of sori and increased the number of brown spores per sorus. These brown rust spores failed to germinate.

**Conclusion:**
*Simplicillium lanosoniveum* was documented as a mycoparasite through experiments designed to both elucidate its effect on disease and to determine its mode of disease suppression.

This research will further our understanding of phyllosphere interactions in the presence of disease. We propose that *S. lanosoniveum* is a candidate for development as a biological control agent that will either provide a pesticide alternative or an effective rotation fungicide for soybean rust and possibly other rusts. The fungus colonized uredinia and aecia of other rusts.

Current research includes experiments to evaluate the colonization potential of field-grown diseased soybeans. Additionally, transmission electron microscopy and confocal microscopy are being used to elucidate mechanisms of infection.

Urediniospores appear hyaline or brown as a result of age or stress. A, Newly produced spores appear hyaline; B, later turning darker, C, and ultimately becoming brown.

D, Colonization of sorus by *Simplicillium lanosoniveum* results in brown spores.

Optical cross sections of the colonization of urediniospores of *Phakopsora pachyrhizi* by *Simplicillium lanosoniveum*. Hyphae were stained with Calcofluor White and viewed with a fluorescent microscope equipped with an automated focal plane stacking accessory and software package. Images were combined with Helicon Focus 4.40.

Scanning electron microscope images of infection of urediniospores of *Phakopsora pachyrhizi* by *Simplicillium lanosoniveum*. A, Urediniospore entwined with hyphae of *S. lanosoniveum*. Arrows indicate a probable point of infection (PI) and conidia (C) of *S. lanosoniveum*. Note the very small size of the conidia. B, Soybean rust sorus colonized by *S. lanosoniveum*.

**A.** Effect of two isolates of *Simplicillium lanosoniveum* on color of urediniospores of *Phakopsora pachyrhizi*. **B.** Germinability of *P. pachyrhizi* as affected by *S. lanosoniveum*. 

A: Hyaline; B: Brown; C: Control; D: Translated.