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## Populations of *Phytophthora sojae* are diverse within single fields

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# Populations of *Phytophthora sojae* are diverse within single fields

## **Abstract**

Phytophthora root and stem rot of soybean (PRR), caused by *Phytophthora sojae*, is well known to Iowa growers. The disease occurs throughout the growing season when soil temperatures are above 70 °F and especially following episodes of heavy rain. This spring, damping off due to infection by *P. sojae* (see photo) has been common because of very wet and warm growing conditions.

## **Keywords**

Plant Pathology, Agronomy

## **Disciplines**

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## Populations of *Phytophthora sojae* are diverse within single fields

by Alison Robertson, Department of Plant Pathology, Silvia Cianzio, Department of Agronomy, and Sarah Cerra, Department of Plant Pathology

*Phytophthora* root and stem rot of soybean (PRR), caused by *Phytophthora sojae*, is well known to Iowa growers. The disease occurs throughout the growing season when soil temperatures are above 70 °F and especially following episodes of heavy rain. This spring, damping off due to infection by *P. sojae* (see photo) has been common because of very wet and warm growing conditions.



*Damping off of soybean caused by Phytophthora sojae. (Palle Pedersen)*

*Phytophthora sojae* is usually classified into races based on the 14 known resistance genes (*Rps*) present in soybean that it can defeat. There are more than 55 identified races; however, this pathogen continues to diversify and as a result, this number classification system has become cumbersome. Pathotype or virulence formulae now are replacing the race number system. The pathotype of a given isolate is a list of the resistance genes it can overcome; for example, pathotype (1a, 1c, 3a, 3b, 6, 7) can defeat resistance genes *Rps1a*, *Rps1c*, *Rps3a*,

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*Rps3b*, *Rps6*, and *Rps7*.

Resistant soybean varieties are available to manage PRR. There are 14 known *Rps* genes. In Iowa, the most commonly deployed *Rps* gene is *Rps1k*, followed by *Rps1c*. However, the prevalence of races/pathotypes of the pathogen that can overcome these resistance genes is on the increase. Surveys examining the diversity of *P. sojae* in Iowa are ongoing. The resultant information is important to soybean breeders as they develop resistant germplasm. This information also is important to agribusinesses and growers alike for determining what varieties to grow.

We recently completed an in-depth survey of the diversity of the *P. sojae* population in two commercial Iowa soybean fields with a history of PRR: one near Albion in Marshall County, and the other near Albert City in Buena Vista County. Thirty composite soil samples of 6-8 cores each were collected from each of these fields. *P. sojae* was isolated from the soil samples and each isolate was identified to race or pathotype.

### **Some important findings include:**

1. **The population of *P. sojae* within a single field is highly diverse.** At the Albion field, a total of 13 isolates of *P. sojae* belonging to nine races and three pathotypes were recovered. Similarly, at Albert City, 21 isolates belonging to 10 races and nine pathotypes were recovered.

2. **The diversity of the *P. sojae* population in each field was sufficient to defeat all 14 known *Rps* genes. That means that there are no soybean varieties known with complete resistance to PRR in these fields.** Fifty percent of isolates collected were able to defeat the *Rps1k* gene; 25 percent were able to defeat *Rps1c*; and 34 percent were able to defeat *Rps6*, a resistance gene currently being incorporated into local Iowa State University varieties.

3. The population of *P. sojae* within the root zone of a single soybean plant can be diverse. Up to five isolates of *P. sojae* belonging to as many races/pathotypes were recovered from some soil samples. Thus, a single soybean plant can be exposed to members of the pathogen population that are able to defeat different *Rps* genes. For example, at the Albert City field, the following isolates were collected from a single soil sample: AC3, able to defeat *Rps1a*, 3a, and 7; AC7, defeats *Rps1a*, 1d, 1k, 3a; AC9 defeats *Rps1c* and 7; and AC163 defeats *Rps1a*, 1k, 4, 6, and 7. Therefore, while a variety with *Rps1k* resistance would be resistant to infection by AC3 and AC9, it would be susceptible to infection by AC7 and AC163.

These findings are very important to breeders and growers alike. Although breeders continue to screen soybean lines for novel *Rps* genes, incorporating partial resistance (also known as field tolerance) into soybean varieties is likely to be more important. Partial resistance is coded for by multiple genes and is effective against all races and pathotypes of *P. sojae*. Although some infection does occur with partial resistance, yield loss is minimal. Growers need to know that field populations of *P. sojae* can be highly diverse and any resistant variety is unlikely to be resistant to all members of the pathogen population. There are soybean varieties available that have some level of partial resistance and a grower should consider planting such varieties in fields with a history of moderate to severe PRR.

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