Notas Científicas

Development of *Sclerotium rolfsii* sclerotia on soybean, corn, and wheat straw, under different soil temperatures and moisture contents

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Abstract – The objective of this work was to evaluate the effect of moisture and temperature on the development of *Sclerotium rolfsii* on soybean, corn, and wheat straw. Wheat straw produced the lowest number of sclerotia. Intermediate soil moisture level (70% of field capacity), and temperatures ranging between 25–30°C favored sclerotia development. No sclerotia were formed at temperatures between 30–35°C, on any type of straw.

Index terms: *Glycine max*, crop rotation, no-tillage, sclerotium blight.

Desenvolvimento de escleródios de *Sclerotium rolfsii* em palhas de soja, milho e trigo, sob diferentes temperaturas e umidades do solo

Resumo – O objetivo deste trabalho foi avaliar o efeito da umidade e da temperatura do solo no desenvolvimento de *Sclerotium rolfsii* sobre palhas de soja, milho e trigo. A palha de trigo proporcionou a formação de menor quantidade de escleródios. Umidade do solo intermediária (70% da capacidade de campo) e temperaturas entre 25–30°C favoreceram a formação de escleródios. Na faixa de 30–35°C, nenhum escleródio foi produzido em qualquer tipo de palha.

Termos para indexação: *Glycine max*, rotação de culturas, plantio direto, murcha de esclerócio.

Since the beginning of the 1980s, emphasis on farming practices in southern Brazil has shifted from conventional tillage to conservation tillage. In this last one, at least 45% of the harvest residues are left on soil surface for conservation purposes (Saraiva & Torres, 1999). Nevertheless, several soybean diseases are favored with no till practices.

Sclerotium blight, caused by *Sclerotium rolfsii* Sacc, is a minor disease of soybean [*Glycine max*. (L.) Merr.], but in certain situations significant yield losses can occur in monoculture or short rotation of soybean with other crops susceptible to the pathogen. Since genetic resistance is not available, to prevent the build-up of inoculum to damaging levels, the rotation of soybean or other susceptible crops with non-host crops such as maize, grain sorghum, wheat, or pasture grasses is recommended (Hartman et al., 1999).

What triggers the soybean infection by *S. rolfsii* is not completely understood. How the changes in tillage practices have affected the prevalence of the disease in the region is also unknown. However, Almeida et al. (2001) found significant differences in stem blight incidence according to the soil management system used. These authors showed that seedling stem blight in conventional and no-till fields were significantly different.

In many instances, disease severity is a consequence of problems such as inadequate fertility (Rodrigues et al., 2002), incorrect pH, soil compaction, poor drainage, herbicide injury (Reichard et al., 1997; Harikrishnan & Yang, 2002) and high levels of nematode infestation (Rodriguez-Kábana et al., 1994). Correcting these problems is the first step towards disease management in soybean (Hartman et al., 1999). However, other factors such as high soil moisture and temperature could be decisive to disease development (Punja, 1985). Recently, Blum & Rodriguéz-Kábana (2004) mentioned the important effect of organic matter on *S. rolfsii* development. In the present study, the effect of straw types, and soil temperature and moisture ranges on *S. rolfsii* sclerotia development was examined.

Isolates of *S. rolfsii* were obtained from soybean and grown in PDA. Sclerotia developed on the surface of the growth medium were scraped off and kept in glass vials at 4ºC.

The first experiment evaluated the effect of wheat (*Triticum aestivum* L.), corn (*Zea mays* L.) and soybean straw on sclerotia development. It was carried out in12x12x5-cm plastic boxes filled with 100 g of sterilized or non-sterilized soil. The straw was cut in 2–5-cm fragments, placed inside a cellophane bag, sprayed with water (1 mL $100g^{-1}$), sealed with regular tape and sterilized at 120ºC for two hours. Sclerotia were inoculated in five places (in each corner and in the center of the boxes), and each box was covered with a specific straw distributed over the soil at the rate of 1g per box. Moisture was maintained at 65% of previously determined field capacity (Serafim et al., 2008). All boxes were incubated at room temperature (26–28ºC) after being covered with a plastic film. Five holes were made in the plastic film for gas diffusion.

Boxes were weighed twice a day to keep the moisture stable. The evaluation was performed using a dissecting microscope and counting the number of sclerotia formed in each box three weeks later. Data were treated as a completely randomized design comprising six treatment combinations arranged in a 2x3 factorial (sterilized and non-sterilized soil x straw type), with six replicates.

In the second experiment, the effect of moisture content associated with soil sterilization on sclerotium formation was evaluated. Three soil moistures (65%, 70% and 75% of field capacity) were used with the three types of straw, distributed over sterilized soil at the rate of 1g per box. Sclerotia were inoculated in each corner and in the center of the boxes. Daily, each box was weighed to maintain the correct moisture content. All boxes were incubated at room temperature (26–28ºC). Sclerotia were counted after two weeks. Analysis of variance was based on a completely randomized design with nine treatment combinations arranged in a 3x3 factorial, with six replicates.

In a third experiment, the effect of temperature and straw type on sclerotia formation at 70% of field capacity was studied. Sclerotia were placed on the sterilized soil in each corner and in the center of the plastic boxes. Straw was distributed over the soil at the rate of 1g per box. Soil moisture was kept at 70% of field capacity. Boxes were incubated at the temperature ranges of 20–25, 25–30, and 30–35ºC, the highest temperature during 16 h, and the lowest 8 h, and sclerotia were counted after two weeks. The design was completely randomized, with nine treatment combinations arranged in a 3x3 factorial, with four replicates.

Analysis of variance was performed after transformation sclerotia number to log (x), in the first experiment, and to $x^{0,5}$, in the second one. Means were compared using Tukey´s test with 5% of probability, based on SAS Institute (2001).

All straw types developed sclerotia. The effect of soil sterilization was highly significant (Table 1). The data presented low variability (CV = 4.52%) and attended all ANOVA requirements after using the transformation log (x). Higher sclerotium formation was always observed in sterilized soil, regardless of the straw type. Corn and soybean were the most favorable straws for the development of these structures. Wheat straw produced the lowest number of sclerotia.

There was significant interaction between moisture and straw types on the formation of sclerotia (Table 1).

Table 1. *Sclerotium rolfsii* sclerotia developed in different types of straw as affected by soil sterilization, soil moisture and soil temperature treatments[(1)].

Straw	Soil		Soil moisture (% field capacity)			Temperature range (ºC)		
	Sterile	Not sterile	65	70	75	20–25	25–30	30–35
Corn	149.0aA	75.2aB	42.2aC	161.2aA	93.7aB	51.8aB	139.5aA	0.16aC
Soybean	139.0aA	62.5aB	57.7aB	109.5bA	96.5aA	34.0abB	99.8bA	0.00aC
Wheat	39.0bA	12.5bB	3.7bC	31.7cA	18.2bB	11.5bA	20.5cA	0.00aA
CV (%)	4.52			8.30			60.17	

[(1)]Means followed by equal letters, capital in the rows and regular in the columns, do not differ by Tukey's test at 5% of probability. Data were transformed using log (x) for soil sterilization, and $x^{0,5}$ for soil moisture.

Corn, soybean and wheat straw produced the highest number of sclerotia at 70% of the field capacity. Sclerotia development decreased at 65–75% of field capacity. Once again wheat showed the lowest sclerotia development.

Temperature had a strong effect on sclerotia formation in corn and soybean straw (Table 1). In the 30–35°C range, no sclerotia were produced in any type of straw tested, although fungal mycelia were observed in the straw fragments. Corn and soybean had similar behavior and wheat showed the lowest sclerotia development in the temperatures 20–25°C and 25–30°C .

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