NOTAS CIENTÍFICAS

Etiology of phomopsis root rot in soybean

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ABSTRACT

Ghissi, V. V.; Reis, E. M.; Deuner, C. C. **Etiology of phomopsis root rot in soybean.** *Summa Phytopathologica,* v.40, n.3, p.270-272, 2014.

In a survey of damages caused by soybean root rot to crops in the south of Brazil for several years, a root rot caused by *Phomopsis* sp has been found with increasing frequency. The primary symptoms are seen when the main root is cut longitudinally, including the death of the wood which shows white coloration and well-defined black lines that do not have a defined format. Thus, based on similarity, it has been called *geographic* root rot due to its aspect resembling irregular lines that separate regions on a map. In isolations, colonies and alpha spores of *Phomopsis* have prevailed. Pathogenicity test was done by means of inoculation in the crown of plants cultivated in a growth chamber. The geographic symptoms were reproduced in plants and the fungus *Phomopsis* sp. was reisolated. In soybean stems naturally infected with pod and stem blight, geographic symptoms caused by *Phomopsis phaseoli* are found. To the known symptoms on stems, pods and grains, that of root rot caused by *P. phaseoli* is now added.

Additional keywords: *Glycine max,* geographic*, Phomopsis phaseoli*, pod and stem blight.

RESUMO

Ghissi, V. V.; Reis, E. M.; Deuner, C. C. **Etiologia da podridão radicular de Phomopsis em soja.** *Summa Phytopathologica***,** v.40, n.3, p.270-272, 2014.

Em levantamento de danos causados por podridões radiculares da soja, em lavouras do sul do Brasil durante vários anos, tem sido encontrado com maior frequência uma podridão radicular causada por *Phomopsis* sp. Os sintomas primários são visualizados quando se corta longitudinalmente a raiz principal, observando-se a morte do lenho ostentando coloração branca, com linhas negras bem definidas, sem um formato definido. Por isso, por semelhança, tem sido chamada de podridão radicular de *geográfico*, pelo aspecto que lembra as linhas irregulares separando regiões num mapa. Isolamentos foram feitos durante várias safras e feita a prova de patogenicidade. Nos isolamentos tem predominado colônias e os esporos alfa de *Phomopsis* sp. A prova de patogenicidade foi feita pela inoculação no colo de plantas cultivadas em câmara de crescimento. Reproduziram-se os sintomas de geográfico nas plantas e foi reisolado o fungo *Phomopsis* sp. Em hastes de soja naturalmente infectadas pela seca-da-haste e da-vagem são encontrados sintomas de geográfico causados por *Phomopsis phaseoli*. Aos sintomas conhecidos em hastes, vagens e grãos acrescenta-se agora o de podridão radicular causada por *P. phaseoli*.

Palavras-chave adicionais: *Glycine max,* geográfico, *Phomopsis phaseoli*, seca-da-haste e da-vagem.

In the 2012/13 growing season, soybean was grown in an area of 27 million hectares, under no till and monoculture, which contributes to an increasing intensity of current and emergent diseases

Soybean crop is attacked by many diseases caused by nematodes, viruses, bacteria and fungi. The latter cause root rot, damping-off, cankers, stem rot, leaf spots, and pod and seed diseases (1, 2, 4). In most soybean fields, weakened plants with thinner stems and leaf yellowing followed by early defoliation are observed. This symptomatology is similar to that of charcoal root rot caused by *Macrophomina phaseolina* (Tass.) Goid, which leads weakened plants to death next to harvest. Uneven crop ripening and yellowing and normal green areas characterize the secondary symptoms of the disease.

In a survey of damages caused by root rot to soybean crops in southern Brazil for several years, a root rot caused by *Phomopsis* sp has been found as most frequent (4). The primary symptoms are seen when the main root is cut longitudinally, evidencing the death of the white-colored wood which shows well-defined lines forming no defined drawing. Plants manifesting the first secondary symptoms already have the geographic symptoms in the taproot. The primary symptoms can be observed even after mechanical harvesting in dead plant stumps.

To diagnose the geographic root rot, removing the root epidermis and observing the presence of geographic symptoms is sufficient. Geographic root rot is easily recognized when the main root of dead or dying plants is cut longitudinally. The symptoms are found in the main root as drawings formed by sinuous well-defined black lines showing no distribution pattern against the white background of the dead wood root. Sometimes the lines form irregular circles. Geographic symptoms can be associated in some cases with charcoal root rot (*M. phaseolina*) and *Fusarium* spp.

Therefore, based on similarity, the common name of the disease *geographic* was proposed by resembling the lines that separate regions on a map.

Symptoms like the ones of geographic root rot, due to colonization by *Phomopsis* sp, can be found along the main stem and main roots of plants near or after maturation. This can indicate the involvement of the same causal agent of pod and stem blight. The irregular dark lines

Figure 1. Geographic root rot symptoms on soybean stems attacked by *Phomopsis phaseoli:* lines of black pycnidia, and a *P. phaseoli* colony in potato sucrose agar on the bottom of a Petri dish, showing similar geographic forms

against the white wood, which characterize the geographic symptoms, are seen on any external portion of the stems (Fig. 1) above the ground. Symptoms with similar forms occur when the fungus *Phomopsis phaseoli* (Desmaz.) Sacc. is grown in culture medium (potato-sucrose-agar) (Fig. 1).

The symptoms of geographic root rot (defined black lines and pycnidia) were distinct from those of charcoal root rot, showing predominantly high microesclerotia density (Fig. 2).

Geographic root rot symptoms are distinct from those described for charcoal root rot. For *Phomospsis* sp., black pycnidia and conidia of alpha and beta type are formed, while for the fungus *M. phaseolina*, only microsclerotia are formed (2, 3).

Several isolates from rotten tissues showing symptoms of geographic root rot, and from pod, stem, and decayed seeds have been obtained over the years. The found fungus belongs to the genus *Phomopsis*, and its white cottony colonies are similar to those caused by pod and stem blight by *P. phaseoli*, producing pycnidia oozing spores.

In field studies involving different tillage systems for soybeans, Reis et al. (4) surveyed the fungi causing root rot. The results demonstrated that *Phomopsis* sp. showed 87% incidence in potato-sucrose medium (PSA).

The following methods were used in the pathogenicity test for geographic root rot isolates: (i) Introduction of toothpicks colonized by the fungus in the plant collar; (ii) seed infection by previous seeding on the fungal culture with water restrictor; (iii) seed immersion in a *Phomopsis* spore suspension; and (iv) seed sowing on the fungus mycelial disc at the bottom of holes made in the substrate.

Two soybean cultivars were inoculated: a conventional RS 153 and the NA 5909 RR, resistant to stem canker [*Diaporthe phaseolorum* var. *meridionalis* (Cook & Ellis) Sacc.Syll.]. Plants were grown in pots containing 1 kg of substrate, totaling five plants per pot and five replicates. The inoculation with toothpick was made when the seedlings reached the V3 growth stage (second trifoliate leaf expanded). The plants were kept in a growth chamber at 23°C and 12 h photoperiod and daily watered.

Secondary wilt symptoms were observed in both cultivars, only in plants inoculated with colonized toothpick. At R8 growth stage (full maturity), plants were removed from the pots, had their roots washed and the cortex removed by scraping. Geographic symptoms were reproduced as shown in Figure 3. Reisolations were made and the colonies were similar to *Phomopsis* isolated from plants collected in the field, showing the same symptoms, as well to those isolated from stem, pods and decayed seeds.

The same symptoms present in plant collars in commercial fields were reproduced in pathogenicity tests. It is likely that infection caused by *P. phaseoli* on stems and at the stem base, weakening the plant, can reach the roots causing geographic root rot.

The isolated fungus belongs to the genus *Phomopsis,* probably *P. phaseoli*, based on its similarity with the pod and stem blight fungus. Colonies showed a white-to-light brown color, flat mycelium and black pycnidia of oozing conidia resembling the characteristics described for *P. phaseoli* isolated from soybean seeds, stems and pods. The size of alpha spores was 2.5 – 3.25 x 6.25 – 7.5 µm, within the limits of measurement described in the literature for the fungus *P. phaseoli* (2). Beta conidia were not found in the culture medium. Beta conidia on seeds inoculated with the fungus *P. phaseoli,* and in decaying stage, were found. They were hyaline and had one curved end, similar to that

Figure 2. Geographic root rot symptoms (*Phomospsis phaseoli*) (a), compared with signs of charcoal root rot (*Macrophomina phaseolina*) (b).

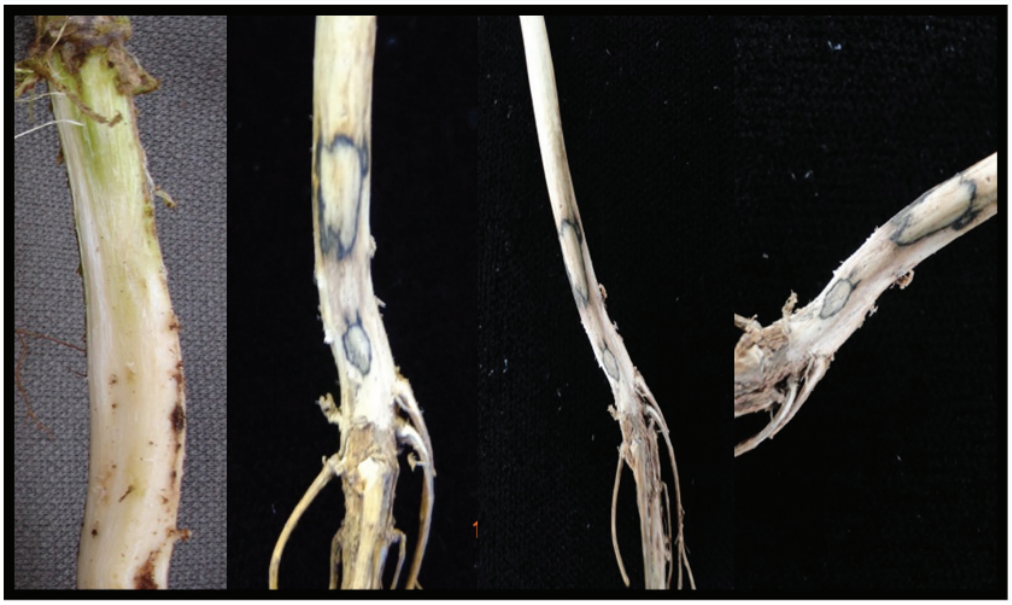

Figure 3. Symptoms of geographic root rot on soybean roots inoculated by using the method of toothpick colonized with *Phomopsis phaseoli* mycelium (on the left, a healthy root).

described in the literature for the fungus *P. phaseoli* (1, 2, 3)

The inoculated plants showed the same symptom of naturally infected plants in the field, and the isolated fungal colonies were similar to the original colonies, supporting thus that *P. phaseoli* was causing geographic root rot in soybean.

It can be concluded that geographic root rot, the main root rot affecting soybean in southern Brazil, is caused by *Diaporthe phaseolorum*. Anamorfo: *Phomopsis phaseoli* (*Diaporthe phaseolorum* var. *sojae* (Cooke & Ellis), the causal agent of pod and stem blight. The common name of geographic root rot was given due to its aspect resembling the irregular black lines that separate regions on a map. Soybean geographic root rot is already well established among technicians in the southern region.

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