

Progress of witches broom disease of cotton in Mato Grosso State, Brazil

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ABSTRACT

The aim of this work was to study the climatic conditions that determine the progress of cotton witches broom disease, caused by *Colletotrichum gossypii* var. *cephalosporioides*, one the most important cotton diseases in Mato Grosso State, Brazil. The experiment was carried out in the 2001 growing season. A susceptible cultivar was planted in an area of 0.3 hectare in Sapezal city, in the northern region of Mato Grosso. A termohygrograph was installed in the center of the experimental area to measure temperature and relative humidity. Equipment to measure rainfall was also installed in this area. The disease was assessed by using the following disease index/scale: 1: no disease; 2: leaf spots on the young leaves; 3: leaf spots on the leaves and initial witches broom; 4: leaf spots on the leaves, witches broom and reduction of internodes and 5: leaf spots on the leaves, severe witches broom, reduction of internodes and severe stunting of plants. Disease severity was verified when plants were 60 days old. Climatic conditions conducive for the occurrence of high severity of witches broom disease were: humidity above 90%, temperatures between 18 and 20 °C and heavy rainfall at least 30 days before the highest disease index.

Introduction

Witches broom disease is distributed in almost all the states where cotton is in Brazil cultivated and is one of the most important cotton diseases in Brazil (Araújo *et al.*, 1998). Under favorable climatic conditions this disease can cause severe damage to cotton and reduces yield. Kimati (1980) reported losses of 20 to 30% in the São Paulo State, which increased to 85% under severe incidence. It is the most important cotton disease in the Mato Grosso State, the main cotton producing area of Brazil, and can cause more than 80% of losses, depending on the susceptibility of the variety planted by farmers, age of plants at infection and climatic conditions (Freire *et al.*, 1997).

The disease is caused by *Colletotrichum gossypii* (South) var. *cephalosporioides* (A.S. Costa). Although there are several ways to transmit the pathogen, the most important mechanism is through contaminated seeds (on seed surface or internally) (Lima *et al.*, 1984). The pathogen can survive on infected crop debris or in the soil and infect cotton plants in the following season. The disease can also manifest as damping off in the seedling stage.

The most efficient method to control this disease

is to plant resistant varieties. The use of healthy seeds, crop rotation and seed treatment with systemic fungicides can contribute to the reduction of disease levels.

Although little information is available about the optimum climatic conditions that would cause epidemic outbreaks of the disease, Carvalho (1981) reported, while studying the physiology of the pathogen in isolates originating from cotton producing areas from Goiás State, that the optimum temperature for pathogen growth was 28 °C. Pathogen growth was reduced below 15 °C and above 33 °C. Therefore, it can be expected that the development of the pathogen is inhibited under extreme temperatures and that the rate of disease progress would consequently be slower in the field.

Costa (1939) observed that *C. gossypii* var. *cephalosporioides* was disseminated quickly from inoculated to non inoculated plants. Abrahão (1961), studying the disease under field conditions, reported that the disease usually occurs in only a few plants and that even one or two plants can act as the center of dissemination. Under the conditions of the Mato Grosso State, it is possible that the disease dissemination occurs quickly and severely in the majority of the cotton producing regions, especially in those where the relative humidity and temperature are favorable during the season and when rain and wind are present, which can help with inoculum dissemination. The initial inoculum play a very important role in dissemination of the disease, therefore, control of the disease is also dependent on sanitation, seed quality and on cultivation practices, especially if cotton is cultivated under monoculture in the same area.

The objective of the present paper was to study the climatic conditions that are favorable for outbreaks of witches broom in the Mato Grosso State of Brazil.

Experimental procedure

The experiment was carried out in the Sapezal city region, where several outbreaks of the disease occurred in the previous seasons. A cotton variety, susceptible to witches broom, was planted. The trial was planted in randomized blocks with four replications and each experimental unit consisted of four rows of 5 m each. A termohygrograph, to measure relative humidity and temperature, was installed in the center of the experimental area. During the period of that cotton plants would be most susceptible to the disease, the severity of witches broom was assessed each week, using the following disease index/scale: 1=plants without symptoms; 2=plants with necrotic spots on the young leaves; 3=plants with necrotic spots on the young leaves and beginning the typical witches broom symptoms; 4=plants with necrotic spots on the leaves, witches broom and short internodes; 5=plants with necrotic spots on the leaves, excessive witches broom and se-

vere stunting of the plants. Based on the results, a disease progress curve was plotted and associated with the measured climatic variables.

Results and Discussion

The disease increased from March 4th to March 18th and the highest disease index was registered between April 1st and April 8th. During this period, the average maximum temperatures ranged from 28 °C to 30 °C and the average minimum temperatures from 15 °C to 18 °C. The average number of hours with a relative humidity during the period of highest disease severity was 11.8 during the day. No days with a relative humidity higher than 90% in the interval from 20 °C to 30 °C, the most favorable temperatures for the development of *C. gossypii* var. *cephalosporioides*, were recorded. However, it was found that relative humidity higher than this disease index was observed during all the time that the disease increased and had higher indexes (Figure 1). This shows the importance of relative humidity for the development of the disease and that infection occurred at temperatures lower than 20 °C in the studied conditions

It was verified that the highest disease index occurred when plants were 60 days old and little rainfall occurred. The results presented in this paper confirm results obtained earlier by Santos (1993). This author verified that the progress of witches broom in the Minas Gerais State was higher when relative humidity was at a maximum of 90.2% and a minimum temperature 18.3 °C.

Although the highest incidence of witches broom disease occurred under little rain in comparison with the previous month, in the present study it was confirmed that the disease incidence increased since the plant was 30 days old. It happened in the first days of March and this means that the heavy rainfall recorded in the period before the highest disease severity occurred, had an important influence on the inoculum dispersion in the planted area and contributed to higher disease indexes later.

Conclusions

Optimum conditions for the development of witches broom in cotton were:

- Relative humidity higher than 90%
- Temperatures between 18 and 20 °C
- Heavy rain at least 30 days before the highest disease severity.

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Figure 1. Witches broom disease severity in relation to temperature (°C) (maximum and minimum), rainfall and days with relative humidity above 90%.

