RESEARCH REPORT: SEASONAL OCCURRENCE OF SPORES OF THE COTTONBALL FUNGUS, MONILINIA OXYCOCCI.

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Abstract

A Burkard 7-day recording volumetric spore trap was used to collect ascospores and conidia of Monilinia oxycocci from a commercial cranberry bog in Wood Co., WI in 1987 and 1988, and 1986-1988, respectively. Ascospores were detected over a period of approximately 4 weeks starting 5 May in both years. Conidia were collected for 34, 30, and 26 days beginning 7 June, 6 June, and 17 June in 1986, 1987, and 1988, respectively. Both ascospores and conidia were collected continuously during these periods and showed a diurnal periodicity. No overlap of spore types was observed in any year. Ascospores were collected beginning approximately 1 week prior to bud break until about 1 week prior to the onset of bloom. Each year conidia first were collected at different times in relation to cranberry bloom; about 10 days before bloom in 1986, at the start of bloom in 1987, and at 50% bloom in 1988.

Introduction

Cranberry cottonball, caused by *Monilinia oxycocci*, is the most important field disease of cranberry in Wisconsin. We have been studying the disease for the last several years to determine the specific periods when infection occurs in the field. First, an overview of the disease cycle will be presented, and then results from research to determine the environmental parameters that are associated with the presence of airborne inoculum in a naturally infested commercial cranberry bog will be discussed.

Cottonball Disease Cycle

In the spring, apothecia develop from overwintered sclerotia. Ascospores (spores produced by sexual processes in the apothecia) infect developing shoots. Conidia (asexual spores) then form on stems, pedicels and petioles of blighted shoots. The conidia are reported to only infect blossoms, through which the fungus enters the developing fruit. Infected fruit develop apparently normally, without any external symptoms, until late summer or early fall when the fungus ramifies through the fruit walls and forms a sclerotium beneath the intact epidermis. These stromatized fruit then mummify. The mummies overwinter in the soil and duff or litter layer at the base of the vines and in the spring the cycle repeats.

Results

Airborne spores were collected using a Burkard 7-day recording volumetric spore trap. A Campbell Scientific 21X Datalogger was used to monitor the following environmental parameters:

duration and amount of rainfall or irrigation,
relative humidity in the canopy,
wind speed,
periods of leaf wetness,
ambient air temperature,
air temperature in the canopy,
duff temperature, and
soil temperature at a depth of 4 cm.

Spore trap tapes were mounted on microscope slides and stained. Ascospores and conidia were counted at deposition intervals of 1 hr. In 1987, ascospores were detected in low numbers beginning day 125 (5 May) and were last detected on day 155 (4 June). The peak period of ascospore collection lasted for 16 days. During this period, buds began to break around day 133 (13 May) and by day 140 (20 May) most buds had broken. Conidia were collected beginning day 157 (6 June) and were last collected on day 186 (5 July). The conidium peak lasted 15 days. The onset of bloom coincided with the onset of conidium collection at about day 157. Full bloom was around day 175 (24 June). There was a two day lag between the last day that ascospores were detected and when conidia were first detected. In each case, once the major spore peak began, spores were collected in a single continuous shower.

The same patterns of spore collection were seen in 1988 except that the spore peaks occurred 10 days later. The peak period of ascospore collection lasted only 11 days as opposed to 16 days in 1987. There was a considerably longer lag time between the last day that ascospores were detected and the first day that conidia were detected in 1988 than in 1987; 15 days vs 2 days, respectively. Bud break and blossoming occurred during approximately the same time periods as in 1987. Bud break occurred during the week beginning day 133 (13 May), and blossoming began about day 154 (3 June) with full bloom at about day 176 (25 June). While in 1987 the spore showers coincided closely with bud break and blossoming, in 1988 they occurred quite a bit later. Bud break was just prior to the ascospore shower and the conidium shower did not occur until 50% bloom.

When the spore peaks from both years are aligned, it is striking that the amount of time from the beginning of the ascospore peaks to the beginning of the conidium peaks is the same for both years, 32 days. It follows that shoots that are infected at the beginning of the ascospore shower will be shedding conidia 32 days later. Regardless of the fact that the ascospore peaks vary in duration in each year, 16 days in 1987 and only 11 days in 1988, in both years the amount of time from the beginning of the ascospore peak to the beginning of the conidium peak was the same. This suggests that the onset of conidium production is a function of the latent period rather than external environmental factors or host development.

Daily spore count totals were compared with daily rainfall and irrigation totals, and with maximum, mean, and minimum soil and duff temperatures. Dips in the ascospore peaks appear to correspond to rain/irrigation events. Based on temperature data, these are probably irrigation events for frost protection. Dips in the peaks of conidia also correspond to wetness events and may be due to the scrubbing effect of rain on the airsporae.

In 1988, most sclerotia bearing apothecia were found in the duff. In 1987, however, a large number of the sclerotia bearing apothecia were buried in the soil up to several centimeters. Of particular interest were the relatively steady duff and soil temperatures that were found up to the beginning of the ascospore peak. In both years, a marked rise in temperature occurred at about the same time as the ascospore peak began. This pattern suggests that it may be possible to develop a temperature model to predict the onset of the ascospore shower.

A clear diurnal periodicity was observed in the numbers of ascospores caught per hour. Almost all spores in both years were collected between 10 AM to 9 PM. In 1987, most spores were collected from 4-5 PM, and in 1988, one hour later; from 5-6 PM. The number of conidia caught per hour in 1986, 1987, and 1988, also shows a diurnal periodicity, although not as pronounced as for ascospores. Peak conidium abundance was around midday. This maybe due to the drying of the morning dew off the canopy so that the wind was able to pick up and disperse the spores. However, statistical correlations of hourly spore counts with environmental data have not yet been attempted.

Conclusions

1. It appears that the latent period is the major factor in determining the onset of the conidium shower following ascospore infection.

2. In 1987, spore catches coincided closely with bud break and blossoming. Whereas in 1988, spore catches occurred at the end of bud break and relatively late in bloom.

3. Based on soil and duff temperature data, the development of a temperature model for predicting ascospore showers looks promising.

4. Ascospores and conidia, particularly ascospores, show definite diurnal patterns of spore release. It will be interesting to determine if environmental parameters are correlated with these data.