

Cleistothecia of *Sphaerotheca macularis* on Strawberry Plants in Florida

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ABSTRACT

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Cleistothecia of *Sphaerotheca macularis* were found in 1981 for the first time on strawberry plants in Florida. They were found only on plants that had been grown in Maine and Michigan and were transplanted into Florida fruit production fields. Benomyl and sulfur failed to control powdery mildew on these plants. Powdery mildew was widespread on plants that had been grown in five other states, but no cleistothecia were found on these plants, and benomyl or sulfur controlled the disease.

Additional key words: *Fragaria* × *ananassa*

Powdery mildew of strawberry, caused by *Sphaerotheca macularis* (Wallr. ex Fr.) W. B. Cooke (*S. humuli* (D.C.) Burr.), has been reported from most areas of the world where strawberries are grown. Although the disease is widespread, the cleistothecial stage of the fungus has seldom been found (8). Khan (7) and Peries (8) reported that cleistothecia were found only on plants in the greenhouse in England. Cleistothecia have been reported on plants in the field in France (3) and in Canada (4,6). They have been

reported in the United States only once before (1), even though the conidial stage is common in most areas of this country.

The conidial stage of powdery mildew was first reported in Florida in 1962 on plants of *Fragaria chiloensis* that had been imported from Belgium (2). Since 1967, the disease has occurred sporadically in Florida. In some years, little or no powdery mildew is found; in other years, it is widespread and relatively severe until control measures are taken.

In January 1981, abundant cleistothecia in various stages of development were found on leaves and fruit pedicels of Tufts strawberry plants that had been produced by Florida growers in nurseries in Maine and Michigan and were transplanted into fruit production fields in Florida in October 1980. The conidial and cleistothecial stages of powdery mildew persisted in these fields until hot, dry weather occurred in early March.

According to the growers, mildew was

present on the plants before they were dug from the Maine and Michigan nurseries. Because the cleistothecia observed in January and February 1981 were on leaves and buds produced after the plants were set into Florida fruit production fields, they obviously developed in Florida. No cleistothecia were found on plants that had been grown in nurseries in Florida, North Carolina, Tennessee, Arkansas, or California, even though powdery mildew was widespread on these plants in November and early December 1980 and recurred in a few of these fields in February 1981.

During the 1980-1981 season, as in past years, powdery mildew was completely controlled by two to four applications of sulfur (2.2-5.6 kg/ha) or benomyl (.56 kg/ha) at 4- to 7-day intervals, except on plants from Maine and Michigan. Powdery mildew was not controlled on the Maine and Michigan plants even in fields that received 10-12 applications of benomyl plus five applications of sulfur. Even some of the fruit on these plants became infected. Infected green fruit became bronze or brownish, and a network of very fine, shallow cracks developed in the epidermis. The cracks could be seen only with the aid of a hand lens. As the infected fruit ripened, the cracks widened, and the fruit turned reddish brown and had a dull, dry appearance.

Horn et al (5) reported that severely

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infected fruit in Louisiana became white from profuse sporulation of the fungus. Very little sporulation occurred on infected fruit in Florida.

It is unlikely that efforts to control powdery mildew on the Maine and Michigan plants failed because of poor coverage, because excellent control of other foliar diseases and fruit rots was obtained in these fields. Ascospores within the cleistothecia may be protected from the fungicides and may continuously initiate new infections. Gilles (3) and Peries (8) in France and England, respectively, were unable to find viable ascospores and concluded that they were of little or no importance in survival or initiation of primary infections. The viability of ascospores in Florida was not tested. However, even if ascospores were viable, spraying at 1-wk intervals over a 12-wk period should control such infections.

The most plausible explanation for the difficulty of controlling powdery mildew on the Maine and Michigan plants is that the particular race of the fungus is resistant

to benomyl and that not enough successive applications of sulfur were used to control the disease. Sulfur was applied in these fields during two to three consecutive weeks then discontinued for 2-4 wk. Benomyl was applied during the intervening weeks. Although two applications of sulfur 7 days apart have usually given complete control of lighter infections in Florida, they probably were not sufficient to eradicate the severe infections on the Maine and Michigan plants. The disease would then resurge while benomyl was being applied if the particular race of *S. macularis* were resistant to benomyl.

It would be prudent to prevent further introduction into Florida of races of *S. macularis* that may be resistant to benomyl. Therefore, we suggest that Florida growers who produce plants in northern states inspect the nurseries for powdery mildew frequently during the summer and begin applying fungicides recommended in the particular state for controlling powdery mildew as soon as the disease is detected. Every effort

should be made to completely control the disease before the plants are dug and transported to Florida in October.

LITERATURE CITED

1. Arthur, J. C. 1887. Report of the botanist of the New York Agricultural Experiment Station. Pages 275-276 in: Fifth Annu. Rep. N.Y. Agric. Exp. Stn. for 1886.
2. Burnett, H. C., and VanPelt, H. 1962. Powdery mildew on strawberry in Florida. Plant Dis. Rep. 46:348.
3. Gilles, G. 1961. Contribution à l'étude de *Sphaerotheca humuli* (D.C.) Burr. sur fraisières; biologie et lutte. Meded. Landbouwhogeschool. Opzoekingsstn. Staat Gent 25:1124-1139.
4. Gourley, C. O. 1979. Cleistothecia of *Sphaerotheca macularis* on strawberry leaves in Nova Scotia. Can. Plant Dis. Surv. 59:80.
5. Horn, N. L., Burnside, K. R., and Carver, R. B. 1971. Powdery mildew of strawberry. Plant Dis. Rep. 56:368.
6. Jhooty, J. S., and McKeen, W. E. 1962. The perfect stage of *Sphaerotheca macularis* on strawberry plants. Plant Dis. Rep. 46:218-219.
7. Khan, M. L. 1960. The perithecial stage of *Sphaerotheca humuli* on strawberry. Plant Pathol. 9:18.
8. Peries, O. S. 1962. Studies of strawberry mildew caused by *Sphaerotheca macularis* (Wallr. ex Fries) Jaczewski: I. Biology of the fungus. Ann. Appl. Biol. 50:211-224.