

## Anthracnose Fruit Rot of Strawberry<sup>1</sup>

J.C. Mertely and N.A. Peres<sup>2</sup>

Anthracnose fruit rot, caused by the fungus *Colletotrichum acutatum*, is an important disease for strawberry production worldwide. Other species of *Colletotrichum*, such as *C. fragariae* and *C. gloeosporioides*, are less frequently involved in fruit rot. Although fruit rot is the most important symptom caused by *C. acutatum*, the fungus can also attack other parts of the plant including the crown, leaves, petioles, and roots.

### Pathogens and Symptoms

Symptoms of anthracnose fruit rot appear as dark and sunken lesions on infected fruit (Figure 1). The appearance of crusty masses of spores on and under strawberry seeds is more diagnostic of this disease (Figure 2). On green fruit, anthracnose lesions are small (1/16 to 1/8 inch across) hard, sunken, dark brown or black. Lesions on ripening fruit are larger (1/8 to 1/2 inch) hard, sunken, and tan to dark brown. During wet weather, the lesions become covered by sticky, light orange ooze composed of millions of spores (conidia) in a mucilaginous matrix (Figure 3). When conditions are favorable for infection, multiple lesions nearly cover the fruit and lesions may appear on petioles (Figure 4). Strawberry flowers are highly

susceptible and blighted flowers turn brown and remain attached to the plant (Figure 5), a symptom also produced by the fungus *Botrytis cinerea*. Small black spots on young button-sized fruit may also develop from flower infections (Figure 6).

### Disease Development and Spread

When conditions are favorable, anthracnose fruit rot is the most important disease of strawberry in Florida. Crop losses occur mostly in the field, since forced air pre-cooling and refrigeration suppress disease development after harvest. Because *C. acutatum* is a strong invader of runner plants in the nursery, infected transplants are a common source of inoculum for the production field. Weeds and other plants around production fields may also be colonized by inoculum from a diseased strawberry crop. In theory, these non-strawberry hosts could provide disease inoculum for the next crop, although this has not been demonstrated. *C. acutatum* appears to spread first on the foliage, often without causing visible symptoms. Some conidia are formed on green leaves and petioles, and more are produced as the tissue ages and dies. Molecular analysis of *C. acutatum* revealed that the population on strawberry

1. This is document PP-207, a publication of the Plant Pathology Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Publication date: March 2005. Please visit our Website at <http://edis.ifas.ufl.edu>.

2. J.C. Mertely, coordinator programs/services, and N.A. Peres, assistant professor, Plant Pathology Department, Gulf Coast Research and Education Center--Dover FL; Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL 32611.

**The use of trade names in this publication is solely for the purpose of providing specific information. UF/IFAS does not guarantee or warranty the products named, and references to them in this publication does not signify our approval to the exclusion of other products of suitable composition.**

reproduces asexually and has limited diversity. Conidia (asexual spores) are moved from the foliage to flowers and fruit by splashing water and harvesting operations. There they germinate and infect. As anthracnose lesions develop, abundant spores are formed which may be moved to other plants and new fields on equipment and harvesters. Warm wet weather favors infection and disease spread.

## Control

Anthracoze fruit rot is best controlled by exclusion, i.e., by not introducing the pathogen into the field in the first place. Transplants should be obtained from pathogen-free nurseries. In addition, moving personnel and equipment from diseased fields into healthy fields should be avoided without proper cleaning and disinfection. Planting resistant cultivars such as Carmine and Sweet Charlie has consistently controlled anthracnose, possibly because *C. acutatum* lacks the genetic diversity to overcome this resistance. When moderately susceptible cultivars (e.g., Strawberry Festival) or highly susceptible cultivars (e.g., Camarosa and Treasure) are grown, regular applications of fungicides are often needed to suppress the disease.

In central Florida, strawberry disease management is based on the use of captan or thiram. Regular weekly applications of these broad-spectrum protectant fungicides prevent extensive colonization of the plant and suppress flower and fruit infections. Because weather conditions are less favorable early in the season, those applications can be made at lower label rates. Often a few anthracnose-infected flowers and fruit in late January or early February lead to epidemics during warm, rainy weather in February and March. During the critical January to March period, protectant fungicides should be applied at higher label rates and additional fungicides may be needed for anthracnose control. Additional fungicides can be applied when the disease appears, or proactively throughout the critical period. If the decision made is to wait, fields should be scouted regularly to detect anthracnose early. Plants should be examined for blighted flowers (Figure 5) or black spots on small green fruit (Figure 6) approximately one week after rain events. When the disease is found, a strobilurin fungicide such as Abound® or

Cabrio® should be tank mixed with the standard protectant. Switch® is a good alternative to the strobilurins when double cropping is not planned. Captevate®, Pristine®, and Switch® are particularly useful during the main bloom period in late January and early February. Each product contains two active ingredients that either suppress anthracnose and/or protect flowers from *Botrytis cinerea*. One active ingredient in Captevate® is captan. Tank mixes or higher rates of protectant fungicides should be continued until the end of the season, or until dry weather completely suppresses the disease. Strobilurin fungicides such as Abound®, Cabrio®, and Pristine® should not be applied more than four or five times per season to avoid the development of resistance. If a blocking program is followed, no more than two sequential applications of Abound®, Cabrio®, Pristine®, Captevate®, or Switch® should be made. More information about these products is given in the Table 1.



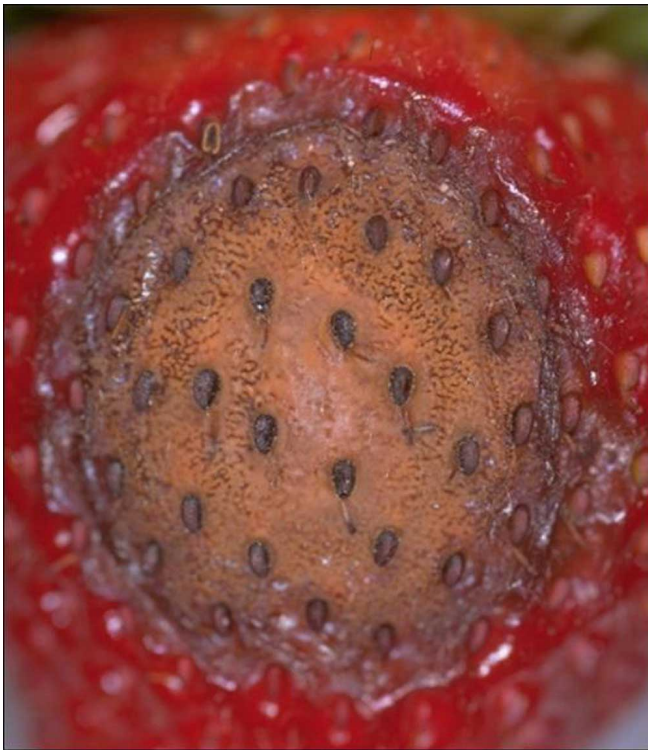
**Figure 1.** Anthracnose lesions on a ripening fruit. Credits: UF, GCREC



**Figure 2.** Spores of *C. acutatum* on seed. Credits: UF, GCREC



**Figure 4.** Anthracnose lesions on petioles. Credits: UF, GCREC



**Figure 3.** Spore mass of *C. acutatum* on anthracnose lesion. Credits: UF, GCREC



**Figure 5.** Anthracnose lesions on petiole. Credits: UF, GCREC





**Figure 6.** Anthracnose lesion on small fruit. Credits: UF, GCREC

**Table 1.** Products labeled in Florida for the control of Anthracnose fruit rot.

Trade Name	Active ingredient	Type	PHI or REI* (hours)	Comments
Captan	captan	multi-site protectant	24	Suppresses anthracnose and Botrytis. Should not be mixed with bicarbonate or sulfur fungicides.
Thiram	thiram	multi-site protectant	72	Suppresses anthracnose less effectively, and Botrytis more effectively than captan.
Abound	azoxystrobin	strobilurin	4	Do not add silicone surfactants or mix with EC formulations.
Captivate	captan + fenhexamid	protectant + anilide	24	Captan suppresses anthracnose and fenhexamid controls Botrytis.
Cabrio	pyraclostrobin	strobilurin	24	Controls anthracnose and suppresses powdery mildew.
Pristine	boscalid + pyraclostrobin	carboxamide + strobilurin	24	Pyraclostrobin controls anthracnose and boscalid controls Botrytis.
Switch	cyprodinil + fludioxonil	pyrimidine + pyrrole	12	For anthracnose and Botrytis. One year plant-back restriction.
<p>*PHI = Post harvest interval. REI = Restricted entry interval.  Recommendations given in this fact sheet are based on experimentation and statements from the manufacturer. Consult your product label for specific use requirements and restrictions.</p>				