

# Powdery Mildew of Strawberries<sup>1</sup>

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Powdery mildew, *Podosphaera aphanis* (syn. *Sphaerotheca macularis*), occurs in most areas of the world where strawberries are grown.

## Pathogen and Symptoms

*P. aphanis* infects leaves, flowers, and fruit. Early foliar infections are characterized by small white patches of fungus growing on the lower leaf surface. On susceptible cultivars, dense mycelial growth and numerous chains of conidia (spores) give these patches a powdery appearance (Figure 1). Under favorable conditions, the patches expand

and coalesce until the entire lower surface of the leaf is covered (Figure 2). In some strawberry cultivars, relatively little mycelium is produced, making it difficult to see the white patches. Instead, irregular yellow or reddish-brown spots develop on colonized areas on the lower leaf surface and eventually break through to the upper surface (Figure 3). The edges of heavily infected leaves curl upward (Figure 4). At times, dark round structures (cleistothecia) are produced in the mycelia on the undersides of leaves (Figure 5). Cleistothecia are initially white but turn black



Figure 1. *Podosphaera aphanis* mycelia on strawberry leaf surface  
 Credits: UF, GCREC



Figure 2. Lower leaf surface of strawberry covered with powdery mildew  
 Credits: UF, GCREC

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as they mature. The fungus also infects flowers, which may produce aborted or malformed fruit. In addition, *P. aphanis* colonizes older fruit, producing a fuzzy mycelial growth on the seeds (Figure 6). Both types of infection may reduce fruit quality and marketable yields.



Figure 3. Reddish-brown spot reaction caused by *Podosphaera aphanis* in some cultivars  
Credits: UF, GCREC

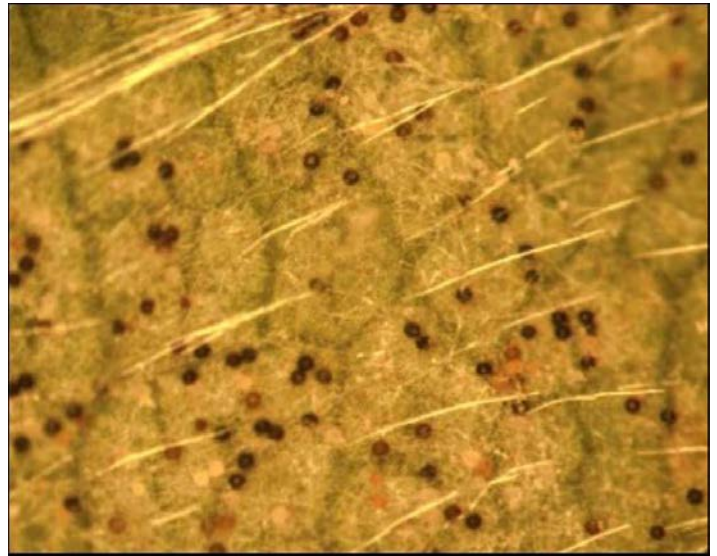


Figure 5. Micrograph of *Podosphaera aphanis* cleistothecia on leaf surface  
Credits: UF, GCREC



Figure 4. Curling leaves on plants severely infected with powdery mildew  
Credits: UF, GCREC



Figure 6. *Podosphaera aphanis* on strawberry achenes  
Credits: UF, GCREC

## Disease Development and Spread

*P. aphanis* is an obligate parasite that only infects living tissue of wild or cultivated strawberry. The fungus readily infects living, green leaves in the nursery. Thus, infected transplants are normally the primary source of inoculum for fruiting fields in Florida. When conditions are favorable, conidia produced on infected plants are wind dispersed. Powdery mildew development and spread are favored by moderate to high humidity and temperatures between 60°F and 80°F. Rain, dew, and overhead irrigation inhibit the fungus. Because dry conditions and high humidity are common in greenhouses and plastic tunnels, powdery mildew is typically more severe in protected culture. In open fields in Central Florida, the disease is typically most severe in November and December, usually subsides in January and early February, and may reappear in late February and March.

## Control

Using powdery mildew-free transplants is a good method to control the disease, but even disease-free fields can become infected by conidia blown in from neighboring fields. Cultivars differ in their resistance to powdery mildew. However, the two most popular cultivars, 'Strawberry Festival' and 'Florida Radiance', are susceptible to the disease. Fields with susceptible cultivars should be surveyed regularly for powdery mildew, especially early in the season. Fungicides should be applied preventively or at the first sign of disease to control powdery mildew on susceptible cultivars. This is especially important when using protectant fungicides, such as elemental sulfur. Systemic fungicides have some limited curative action. These include Rally® (active ingredient myclobutanil), which was formerly named Nova®; Procure® (active ingredient triflumizole); Orbit® (active ingredient propiconazole); and Mettle (active ingredient tetraconazole). These products are treated as a group since they belong to the same fungicide class and have similar properties. They have a single mode of action and, for this reason, should be rotated with other fungicides with different properties to avoid the development of resistance. Quintec® and Torino® are newer, highly effective fungicides and have a mode of action different from other powdery mildew products. Other rotational options include Pristine® (pyraclostrobin + boscalid) and Fontelis™ (pen-thiopyrad), but be careful not to exceed four applications of these products per season. Usually, controlling foliar infection helps to prevent fruit infection.

Table 1. Fungicides recommended for control of powdery mildew of strawberries in Florida

Product name (active ingredient)	Fungicide group <sup>a</sup>	Maximum rate per acre per		Min. days to harvest	Remarks
		Application	Season		
(Sulphur) Many brands <sup>b</sup>	M2	Varies	Varies	1	Do not use when temperatures exceed 85°F
Rally® 40 WSP Nova® 40 W Sonoma® 40 WSP (Myclobutanil)	3	5 oz.	30 oz.	0	Do not plant rotational crops until 30 days after last application
Orbit® Tilt® Bumper® 41.8 EC (Propiconazole)	3	4 fl. oz.	16 fl. oz.	0	Do not make more than two consecutive applications
Procure® 50WS (Triflumizole)	3	8 oz.	32 oz.	1	Do not plant leafy vegetables within 30 days, root vegetables within 60 days, or rotational crops not on label for 1 year after application
Mettle® 125 ME (Tetraconazole)	3	5 fl. oz.	20 fl. oz.	0	Do not apply same product within 14 days; do not make more than four applications per season
Quadris Top® (Difenoconazole + azoxystrobin)	3 + 11	14 fl. oz.	56 fl. oz.	0	Do not make more than two sequential applications before alternating to another fungicide group; make no more than four applications/crop
Quilt Xcel® (Propiconazole + azoxystrobin)	3 + 11	14 fl. oz.	56 fl. oz.	0	Do not make more than two consecutive applications and no more than four applications/crop
Fontelis™ (Penthiopyrad)	7	24 fl. oz.	72 fl. oz.	0	Do not make more than two sequential applications before alternating to a fungicide from a different group
Pristine® (Boscalid + pyraclostrobin)	7 + 11	23 oz.	115 oz.	0	Do not make more than two consecutive applications and no more than five applications/crop
Quintec® (Quinoxifen)	13	6 fl. oz.	24 fl. oz.	1	Do not make more than two consecutive applications or more than four applications per crop; do not plant crops not on label for 30 days after application
Torino® (Cyflufenamid)	U6	3.4 oz.	6.8 oz.	0	Do not make more than two applications per year; do not apply more than once every 14 days

<sup>a</sup> Fungicide group (FRAC Code): Numbers (1–37) and letters (M) are used to distinguish the fungicide mode of action groups. All fungicides within the same group (with same number or letter) indicate same active ingredient or similar mode of action. This information must be considered when making decisions about how to manage fungicide resistance. M = multisite inhibitors; fungicide resistance risk is low. Source: <http://www.frac.info/> (FRAC = Fungicide Resistance Action Committee).

<sup>b</sup> For example, Kumulus® DF, Micro Sulf®, Microfine Sulfur, Microthiol® Dispers®, Sulfur 90W, Wettable Sulfur, Wettable Sulfur 92, Yellow Jacket Dusting Sulfur, Yellow Jacket Wettable Sulfur

**Always read a current product label before applying any chemicals.**