



# Angular Leaf Spot: A Bacterial Disease in Strawberries in Florida<sup>1</sup>

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Angular Leaf Spot (ALS) is a bacterial disease caused by *Xanthomonas fragariae* Kennedy & King, a pathogen highly specific to wild and cultivated strawberry, *Fragaria x ananassa* Duchesne (Legard et al. 2003). ALS is an important disease on winter strawberry production worldwide. In the U.S., it ranks 6<sup>th</sup> in economic importance after gray mold (*Botrytis cinerea* L.), verticillium wilt (*Verticillium albo-atrum* Reinke & Berth), powdery mildew (*Sphaerotheca macularis* L.), anthracnose (*Colletotrichum* spp.), and pythium root rot (*Pythium* spp.) (Sorensen et al. 1997). The rapid spread of ALS is influenced by the increasing rate of interchange of plant material.

ALS was first reported in Minnesota in 1960 and since then it has been found in almost all cultivated strawberry areas in the U.S. (Funt et al. 1997). In California, the largest U.S. producer of fresh strawberries, ALS is a minor disease that occurs especially during rainy weather or when overhead sprinkler irrigation is used (Strand 1993). ALS is the only strawberry disease in Florida caused by a bacterium (Howard et al. 1985). Little is known regarding the epidemiology of ALS (Funt et al. 1997;

Mass 1998); however, development of the disease is favored by warm days (20°C/68°F) and cold nights (2–4°C/ 36–39°F) (Howard et al. 1985).

## Symptoms

*X. fragariae*, the causal agent of ALS, is a slow-growing, Gram-negative bacterium that produces water-soaked lesions on the lower leaf surfaces (Figure 1). Lesions begin as small and irregular spots on the undersurface of the leaflets. When moisture is high on the leaves, lesions ooze sticky droplets of bacteria (Howard et al. 1985). As the disease develops, these lesions enlarge and coalesce to form reddish-brown spots, which later become necrotic (Figure 2). A practical way to recognize the disease is to place the leaves against a source of background light where the translucent spots can be seen (Figure 3).

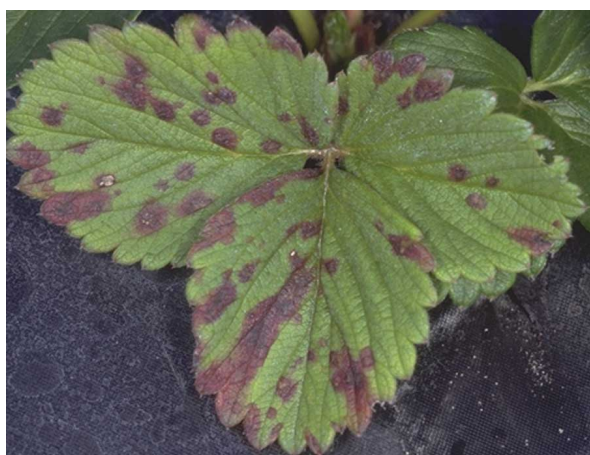
During severe epidemics, the pathogen also can cause lesions on the calyx of fruit that are identical to foliar lesions (Figure 4) and when severe, can make the fruit unmarketable (Legard et al. 2003). The tissue with older damage eventually dies and dries up, giving leaves a ragged appearance (Strand 1993).

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**Figure 1.** Water soaked lesions of Angular Leaf Spot.  
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**Figure 2.** Reddish-brown spots of Angular Leaf Spot.  
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**Figure 3.** Translucent spots of Angular Leaf Spot. Credits:  
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### Spread of the Disease

The primary source of inoculum in a new field is contaminated transplants (Mass 1998). Secondary inoculum comes from bacteria that exude from



**Figure 4.** Water soaked lesion of Angular Leaf Spot on the calyx. Credits: Univ. of Florida, GCREC

lesions under high moisture conditions. Bacteria can survive on dry infested leaves and tissue buried in the soil for up to 1 year (Roberts et al. 1997; Strand 1993). The pathogen can be spread easily by harvesting operations when wet and cool conditions favor the production of bacterial exudate. The pathogen also can be dispersed by rain and overhead sprinkler irrigation. If the disease invades the vascular system of the plant, the disease will be difficult to control. Affected plants may wilt and die.

### Control Methods

The best way to control ALS is to use pathogen-free transplants. Hydrogen dioxide and copper-based products can provide effective control of the disease in some instances, but low rates of copper should be used since phytotoxicity has been documented with repeated sprays. Growers should avoid harvesting and moving equipment through infected fields when the plants are wet. Minimizing the use of overhead sprinklers during plant establishment and for freeze protection will also reduce the spread of the disease.

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