



Bacterial Leaf Spot of Hibiscus in Hawai'i

Scot Nelson

Department of Plant and Environmental Protection Sciences

Endemic and introduced *Hibiscus* species are popular flowering plants grown in landscapes throughout the Hawaiian Islands. A number of important pests and diseases afflict hibiscus species in the state, including the hibiscus erineum mite (*Aceria hibisci*), the Chinese rose beetle (*Adoretus sinicus*), and root-knot nematodes (*Meloidogyne* spp.). Hibiscus is also affected by powdery mildews, other leaf spot diseases, and nutrient deficiencies.

There is a conspicuous bacterial leaf spot disease that occurs on the most commonly grown flowering hibiscus, *Hibiscus rosa-sinensis* L. The disease is found mainly in high-rainfall areas of Hawai'i such as near Kurtistown in the Puna district on the island of Hawai'i. It is one of several distinct bacterial leaf spots of hibiscus found globally. These diseases, caused by different pathogens, can be distinguished by their symptoms (Chase 1986).

In Florida, where these bacterial diseases have previously been studied, they are most common during hibiscus propagation in nurseries, as the high moisture and humidity necessary



Fig. 1. Bacterial leaf spot of *Hibiscus rosa-sinensis* caused by *Pseudomonas cichorii* in a residential landscape in Kurtistown, Hawai'i. Lesions are generally surrounded by a double border of black and purplish-red.

during nursery propagation favor them. In the landscape, however, the diseases develop less often (Chase 1986). Florida, however, does not receive the high levels of precipitation received in some areas of Hawai'i. For example, Hilo and the Puna district can receive 180 inches (457 cm) of rainfall per year. This high level of rainfall favors infection and development of bacterial diseases.

This publication describes a bacterial leaf spot disease caused by *Pseudomonas cichorii* that commonly occurs in wet Hawaiian landscapes. We describe the pathogen, the disease symptoms, and factors contributing to epidemics. We also provide integrated practices for managing this distinctive disease.

Pathogen

The pathogen *Pseudomonas cichorii* (Swing.) Stapp is a gram-negative bacterium. Production of a green fluorescent pigment in culture has placed this pathogen into a broad group of "fluorescent pseudomonads" known as the *P. syringae* group. The fluorescent pseudomonads include many bacterial plant pathogens. Although *P. cichorii* has a relatively broad host range that includes more



Fig. 2. On the abaxial (lower) leaf surface of *Hibiscus rosa-sinensis*, the purplish or reddish marginal tinge and the grayish-white color in the centers of lesions tend to be absent, and lesions are medium brown with a dark margin.



Fig. 3. The distinctive purplish or reddish tinge of lesions may also be absent from adaxial leaf surfaces, depending on the hibiscus cultivar.

than 50 plant genera (CAB International 1965), various strains are specific to distinct hosts and are unlikely to infect and cause disease on all of the reported hosts.

Symptoms

Lesions range from 2 to 10 mm in diameter and are usually surrounded by a two-color border, which is black next to the tan-colored, necrotic center of the lesion and dark purplish-red next to the black margin. A diffuse yellowish halo usually surrounds the whole lesion (Figure 1). The colorful margins of lesions result from the host response to the bacterial biochemistry. The lesions have a similar appearance on the abaxial (lower) leaf surface; they are medium brown with a dark border and pale yellow halo. The purplish or reddish marginal tinge (caused by production of an anthocyanin pigment) and the grayish-white color in the lesion centers tend to be absent from these surfaces (Figure 2). The distinctive purplish or reddish tinge may also be absent from adaxial (upper) surfaces, depending on the hibiscus cultivar (Figure 3). The central necrotic portions of the lesions are tan to whitish and sometimes fall out,

creating a “shot-hole” appearance. Bacterial growth is inhibited by leaf veins, and lesions tend to be angular in shape (Figure 4). The spots can appear on young leaves that have not yet fully expanded, but they reach their maximum size on fully mature leaves (Figure 5). Severe spotting (Figure 6) may cause premature defoliation. Other parts of the hibiscus plant (e.g., flowers, petioles, stems) are not susceptible to the disease.

Disease cycle and epidemiology

Dispersal of bacteria from lesions occurs primarily by splashing or windblown rain. The pathogen infects through wounds and natural openings such as leaf stomata, hydathodes, broken trichomes, and cracks in the cuticle. After penetration, the bacteria multiply between the plant cells and destroy cell walls with enzymes. The cellular contents serve as food for the bacterial population. The optimum temperature for growth of *P. cichorii* and for disease development is from 70–81°F (21–27°C). The pathogen can survive for a period of time on fallen leaves.



Fig. 4. As lesions expand and encounter large leaf veins, margins tend to grow along veins, giving round lesions an angular shape.

Disease management

Bacterial leaf spot of hibiscus can be managed by using a combination of the approaches listed below:

Starting new plants

Start new plants using pathogen-free cuttings. Exclude the pathogen from your property through quarantine.

Resistant cultivars

None of the 10 cultivars of *Hibiscus rosa-sinensis* tested for resistance to *P. cichorii* showed any significant resistance to the pathogen or disease (Chase et al. 1987). However, we lack experimental data for these cultivars in Hawai'i, for other cultivars of this species, and for endemic *Hibiscus*.

Location

Avoid planting susceptible hibiscus in high-rainfall areas such as the Puna district on the island of Hawai'i.

Fertilizer

Fertilizer has been shown to affect severity of many bacterial diseases of ornamental plants. Both the amount and type of fertilizer can affect plant disease development. However, the relationship needs to be determined for each disease. Therefore, observe the



Fig. 5. Small bacterial leaf spots can appear on young leaves that are not yet fully expanded, but lesions only reach their maximum size on fully mature leaves.

effects of your fertilizer practices on the expression of disease symptoms and modify your practices accordingly to realize reduced disease severity.

Alternate hosts

As *P. cichorii* has a potentially wide host range, understand that other plants or crops in your agroecosystem may be affected and require management. For a list of potential hosts of *P. cichorii*, please refer to a publication by CAB International (2009) in the References section.

Sanitation

Sanitation is the periodic removal of diseased plant organs such as leaves from the vicinity of healthy leaves. Routinely prune and destroy branches with heavily diseased leaves. Pick up and destroy fallen leaves, as *P. cichorii* can survive there. Remove and destroy diseased cuttings from nurseries or young transplants.

Bactericides

Although pesticides, including Junction*, Camelot*, Kocide®, Phyton-27®, and Actigard® may be available, foliar sprays of bactericides will not usually control this disease in high-rainfall areas. Always check a pesticide label for instructions on use of the product and whether it is right for your situation.

Moisture management (relative humidity)

Long periods of leaf wetness and high relative humidity values favor infection and disease development. Use the following practices to reduce disease severity by minimizing leaf wetness and relative humidity in the plant canopy:

- **Irrigation.** Avoid overhead sprinkler irrigation. Reduce leaf wetness by using drip irrigation. Limit water applications.
- **Soil drainage.** Ensure that soils in which hibiscus grow drain adequately. This can lower relative humidity around the plant and reduce infection and disease severity.
- **Weed control.** Trim weeds around hibiscus plants to reduce relative humidity.
- **Plant spacing, intercropping.** Use wide plant spacing between hibiscus plants to decrease the probability of bacteria movement among plants. Place non-host plants between hibiscus plants to block the spread of bacteria between plants.
- **Windbreaks.** Avoid planting hibiscus near windbreaks. A breeze will provide aeration of canopies, allowing leaves to dry rapidly after a rainfall.
- **Shade.** Avoid planting hibiscus in heavily shaded areas.
- **Row orientation.** If planting hibiscus in a row, try to orient the row perpendicular to the direction of prevailing trade winds. This will help plant foliage to dry uniformly within the row and reduce spread of the bacteria among plants by wind-driven rain.

Acknowledgements

The author thanks Anne Alvarez and Fred Brooks of the University of Hawai'i for their thoughtful reviews of this manuscript.



Fig. 6. Severe spotting may cause leaves to fall prematurely.

References

- Chase, A.R. 1986. Comparisons of three bacterial leaf spots of *Hibiscus rosa-sinensis*. *Plant Disease* 70:334-336.
- Chase, A.R. Pest management techniques for hibiscus diseases. http://mrec.ifas.ufl.edu/foliage/resrpts/rh_91_4.htm (accessed 12 July 2011).
- Chase, A.R., Osborne, L.S., Yuen, J.M.F., and Raju, B.C. 1987. Effects of growth regulator chlormequat chloride on severity of three bacterial diseases on 10 cultivars of *Hibiscus rosa-sinensis*. *Plant Disease* 71:186-187.
- CAB International. 2009. *Pseudomonas cichorii* ((Swingle 1925) Stapp 1928), bacterial blight of endive. Crop Protection Compendium 2009 No. AQB CPC record pp. Sheet 1965.