

Citrus Canker

Xanthomonas citri subsp. *citri*

Hosts: Lime (*Citrus aurantifolia*), Seville or sour orange (*Citrus aurantium*), pomelo grapefruit (*Citrus grandis*), kaffir lime (*Citrus hystrix*), bitter orange (*Citrus limetta*), lemon (*Citrus limon*), citron (*Citrus medica*), natsudaïdai (*Citrus natsudaïdai*), grapefruit (*Citrus paradisi*), common mandarin or tangerine (*Citrus reticulata*), orange (*Citrus sinensis* or *Citrus sinensis* var. *braziliensis*), satsuma mandarin (*Citrus unshiu*), kalpi papeda (*Citrus webberi*), and Chinese box orange (*Severinia buxifolia*).

Disease common name: Citrus canker.

Pathogen: *Xanthomonas citri* subsp. *citri*; syn.: *Xanthomonas axonopodis* pv. *citri*, *Xanthomonas campestris* pv. *citri*, and *Xanthomonas citri*.

Disease Cycle

Inoculum: Lesions on leaves, stems, and fruit are sources of inoculum.

Transmission: The bacterium is spread by wind-driven rain, contaminated equipment, workers who have come in contact with infected trees, or movement of infected or contaminated plants.

Infection: The pathogen enters through stomata, or other natural openings, and wounds. Heavy rains enhance invasion. The circular spots on the abaxial side of the leaf reflect stomatal entry of the pathogen. The pathogen induces hyperplasia of epidermal and stem cortical tissue, resulting in cankers.

Symptoms and signs: Symptoms appear on all above-ground parts of the plant, such as leaves (Figs. 1–5), twigs (Fig. 6), and fruit (Figs. 7–10), particularly those that are young and actively growing. Canker lesions on stems, young leaves, and fruit appear as small, raised, circular, brownish spots with water-soaked margins, usually with yellow halos. Eventually, these lesions turn grayish white, rupture, and appear corky with sunken centers and yellow halos. Severely infected fruits appear scabbed and deformed (Fig. 8). Sunken craters can occur on fruit, but the lesions do not penetrate deep into the rind. Fruit commonly fall from diseased trees (Fig. 11). Defoliation (Fig. 12) may occur and small branches may be girdled and killed. Leaf miner activity increases disease severity (Fig. 13).

Survival: The bacterium survives in lesions on leaves, stems, fruit, and woody branches.

Disease Management

Quarantine measures are imperative to prevent entry of infected planting materials into canker-free areas. A common practice is to burn infected and adjacent trees and use prophylactic sprays, such as copper compounds. For moderately resistant trees, planting windbreaks, pruning of diseased autumn/summer shoots, and applying copper spray combined with weather forecasting are control practices. The best preventive measure is early detection of the disease before it spreads extensively. Because of increasing levels of international travel, and in spite of rigorous quarantine measures, the disease is likely to be reintroduced into citrus orchards when people inadvertently bring infected citrus fruit and seedlings to disease-free areas.

References

Bradbury, J. F. 1986. Guide to Plant Pathogenic Bacteria. CAB International, Slough, U.K.

Gottwald, T. R., Graham, J. H., and Schubert, T. S. 2002. Citrus canker: The pathogen and its impact. Online. Plant Health Progress doi: 10.1094/PHP-2002-0812-01-RV.

Timmer, L. W., Garnsey, S. M., and Graham, J. H., eds. 2000. Compendium of Citrus Diseases, 2nd ed. American Phytopathological Society, St. Paul, MN.



Figure 1. Sweet orange leaves with lesions and yellow halos. (Courtesy J. Graham)



Figure 2. Natsudaiddai leaf with corky lesions on underside with faint yellowing around some of the lesions. (Courtesy M. Goto)

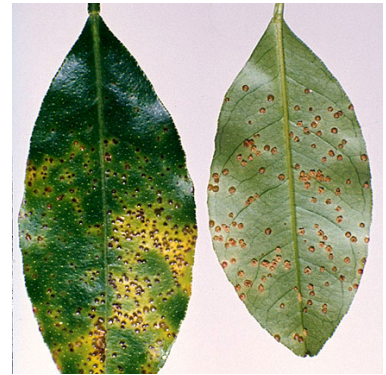


Figure 3. Upper side of an orange leaf exhibiting lesions with yellow halos (left) and underside exhibiting corky lesions with sunken centers and no halos (right). (Courtesy J. Young)

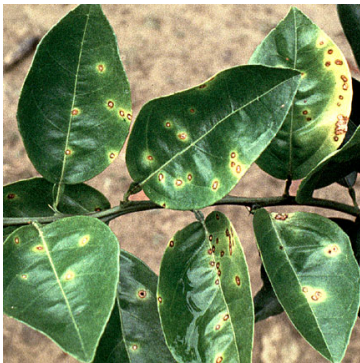


Figure 4. Orange leaves with necrotic lesions and yellow halos. (Courtesy T. Gottwald)



Figure 5. Corky lesions with dark brown halos on underside of lemon leaf. (Courtesy T. Gottwald)



Figure 6. Corky lesions on natsudaiddai twig. (Courtesy M. Goto)

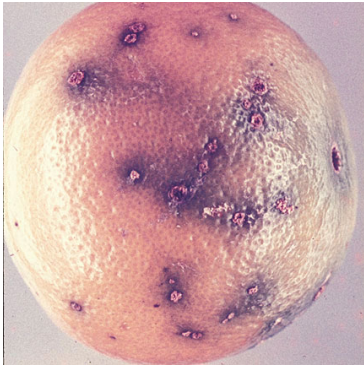


Figure 7. Corky lesions with collapsed centers and blackish halos on lemon fruit. (Courtesy J. Young)



Figure 8. Brown, corky lesions on natsudaïdai fruit. (Courtesy M. Goto)



Figure 9. Corky, raised lesions on grapefruit. (Courtesy T. Gottwald)



Figure 10. Corky, raised lesions surrounded by yellow zones on orange fruit. (Courtesy J. Miller)



Figure 11. Fruit drop of oranges resulting from disease. (Courtesy J. Miller)



Figure 12. Severe infection of orange causes defoliation and sparse foliage. (Courtesy J. Miller)



Figure 13. Orange leaf with lesions in the vicinity of leaf miner tunnels. (Courtesy T. Gottwald)