

Bacterial Dieback of Peach
Pseudomonas syringae pv. *persicae*
 and
Bacterial Canker of Stone Fruits
Pseudomonas syringae pv. *syringae*
 and *Pseudomonas syringae* pv. *morsprunorum*

Hosts: Bacterial dieback of peach, caused by *Pseudomonas syringae* pv. *persicae*, sometimes confused with bacterial canker, has a narrow host range and infects primarily peach, Japanese plum, and nectarine.

Bacterial canker of stone fruits is caused by two different pathovars, *Pseudomonas syringae* pv. *syringae* and *Pseudomonas syringae* pv. *morsprunorum*. *Pseudomonas syringae* pv. *syringae* has a wide host range that includes almond (*Prunus amygdalus* and *Prunus dulcis*), apricot (*Prunus armeniaca*), nectarine (*Prunus persica* var. *nucipersica*), European plum (*Prunus domestica*), myrobalan plum (*Prunus cerasifera*), Japanese plum (*Prunus salicina*), peach (*Prunus persica*), sweet cherry (*Prunus avium*), and sour cherry (*Prunus cerasus*). All stone fruits are susceptible. *Pseudomonas syringae* pv. *morsprunorum* has a more limited host range and infects predominately sweet cherry, sour cherry, plum, and prune.

Common names and pathogens: Bacterial dieback of peach (*Pseudomonas syringae* pv. *persicae*; syn.: *Pseudomonas morsprunorum* f. sp. *persicae*).

Bacterial canker of stone fruits (*Pseudomonas syringae* pv. *syringae* and *Pseudomonas syringae* pv. *morsprunorum*; syn.: *Pseudomonas syringae* and *Pseudomonas morsprunorum*, respectively).

Disease Cycle

Inoculum: *Pseudomonas syringae* pv. *persicae*, *Pseudomonas syringae* pv. *syringae*, and *Pseudomonas syringae* pv. *morsprunorum* have many characteristics in common and there are few reported differences in sources of inoculum. The pathogens overwinter in cankers with the exception of *Pseudomonas syringae* pv. *persicae*, which does this only in some cases. It is likely they all overwinter in buds, leaf scars, and symptomless tissues, thus providing ample inoculum when spring weather arrives. *Pseudomonas syringae* pv. *syringae* is known to grow epiphytically on weeds and leaves of various crop plants. Bacterial populations of these pathogens on leaf surfaces provide an important source of inoculum.

Transmission: Rain during the growing season disperses inoculum throughout an orchard.

Infection: *Pseudomonas syringae* pv. *persicae* invades through pruning stubs and leaf scars during warm weather. It also may directly penetrate buds, shoots, and limbs when damaged by freezing. It has been reported that freeze-thaw cycles caused water-soaking, enabling ingress of the pathogen. Aside from its host range, more research is needed on how it differs from *Pseudomonas syringae* pv. *syringae* and *Pseudomonas syringae* pv. *morsprunorum* with respect to overall etiology. Both *Pseudomonas syringae* pv. *syringae* and *Pseudomonas syringae* pv. *morsprunorum* enter plants through stomata and wounds. They colonize intercellular spaces of spongy parenchyma and both move through parenchyma of the bundle sheath to auxiliary buds, to twigs supporting the leaves, and into the vascular system of branches and trunks.

Symptoms and signs: Images of typical types of disease symptoms caused by the three pathovars on various hosts are shown (Figs. 1–20). Symptoms vary depending upon tree species, cultivar, age of the tree, strain of the pathogen, and environmental factors.

Pseudomonas syringae pv. *persicae* causes necrotic leaf spots with chlorotic halos on peach in spring and superficial necrotic spots on young fruit that may be accompanied by a gummy exudate. During wet springs, the necrotic spots on severely diseased leaves fall off and the leaves dehisce prematurely. Other symptoms that develop on young peach shoots during the winter are an olive-green discoloration around dormant buds, followed by browning. The disease may spread rapidly to older shoots and main branches. Depending upon disease severity, symptoms in spring may vary from death of some buds and twig dieback to death of main branches and the entire tree. Cankers sometimes are seen on less-susceptible cultivars but differ from cankers caused by the bacterial canker disease in that they occur mostly around pruning cuts at the base of an infected shoot. Young trees up to 5 or 6 years old are the most susceptible to this disease.

With bacterial canker of stone fruits, dormant buds may become brown and not open. A zone of brownish, dead, sunken tissues typically appears on the shoots next to infected buds. Infected flowers turn brown, a stage often called blast. Symptoms of infected leaves vary depending on disease severity. They first appear as water-soaked spots, and as the leaves mature, the necrotic spots drop off, giving a shot-hole effect. Another characteristic symptom may be a slight wrinkling and curling of leaves. The leaves tend to have a yellowish cast. Infected fruit exhibit sunken spots with dark centers. Severe infection may result in 100% loss of production. Tree death also is common as the pathogen systemically invades tissues. On the trunk, brownish red lesions are commonly seen if the bark is stripped away. Great amounts of gum are associated with active cankers, but gumming is not always a positive indication of this disease. Other disorders can cause gumming and diagnosing the cause must focus on other symptoms. For example, fungal infection by *Cytospora* spp. is distinguished from bacterial canker by a distinct margin at the top and bottom of the canker. In contrast, bacterial canker has an irregular margin, usually with streaks of discolored tissues extending into the healthy regions. With all three pathovars, young trees are the most susceptible to the canker and dieback phases of the diseases.

Survival: All three pathovars survive in infected buds, in leaf scars, and likely on the surfaces of infected and healthy trees and weeds. Cankers, in the case of *Pseudomonas syringae* pv. *syringae* and *Pseudomonas syringae* pv. *morsprunorum*, also are a major site for survival. There may be some differences with respect to pathogen survival and overall disease etiology among the three pathovars, but more research is needed to improve differentiation.

Disease Management

There are many reports over the years recommending various methods to control these three pathovars and a detailing of them is beyond the scope of this overview. In general, there is great similarity in recommended control measures for these pathovars. With peach dieback, control methods include production of disease-free planting stock, disinfection of pruning tools, use of less-susceptible cultivars, and foliar applications of copper compounds during leaf fall. With bacterial canker of stone fruit, control methods focus on cankers. Cankered limbs should be pruned well below the visible canker. Pruning in early spring and fall should be avoided when bacteria are most active. Tools should be disinfested before pruning healthy trees. Trees may be protected from initial infection with copper compounds applied to flowers and foliage. Copper applications do not retard development of the canker phase once systemic infection has begun. Use of proper rootstock and cultivars for specific geographic regions is important for preventing infection and loss to the disease. It is recommended to avoid use of high-nitrogen fertilizers in mid- to late summer to discourage late-season growth that may become infected by the bacteria.

References

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

Ogawa, J. M., Zehr, E. I., Bird, G. W., Ritchie, D. F., Uriu, K., and Uyemoto, J. K., eds. 1995. Compendium of Stone Fruit Diseases. American Phytopathological Society, St. Paul, MN.



Figure 1. Nectarine with dark cankers on last year's growth (*Pseudomonas syringae* pv. *persicae*). (Courtesy J. Young)



Figure 2. Nectarine twigs with infected spurs (*Pseudomonas syringae* pv. *persicae*). (Courtesy J. Young)



Figure 3. Extensive invasion of a nectarine trunk (*Pseudomonas syringae* pv. *persicae*). (Courtesy J. Young)



Figure 4. Brown, necrotic vascular tissues and gummosis of nectarine twig (*Pseudomonas syringae* pv. *persicae*). (Courtesy J. Young)



Figure 5. Diseased crown and roots of nectarine tree (*Pseudomonas syringae* pv. *persicae*). (Courtesy J. Young)



Figure 6. Various stages of lesion development on nectarine fruit (*Pseudomonas syringae* pv. *persicae*). (Courtesy J. Young)



Figure 7. Peach with cankers on last year's growth, causing bud blight (*Pseudomonas syringae* pv. *persica*). (Courtesy J. Young)



Figure 8. Canker symptoms on apricot branch (*Pseudomonas syringae* pv. *syringae*). (Courtesy S. Sampson/M. Shurtleff)



Figure 9. Droplets of bacterial ooze on young apricot (*Pseudomonas syringae* pv. *syringae*). (Courtesy J. Young)



Figure 10. Brown, infected tissue and rough, cracked bark on apricot branch (*Pseudomonas syringae* pv. *syringae*). (Courtesy J. Young)



Figure 11. Apricot with sparse or no foliage on twigs. Canker symptoms are seen on exposed wood (*Pseudomonas syringae* pv. *syringae*). (Courtesy J. Young)



Figure 12. Numerous reddish necrotic spots on apricot fruit (*Pseudomonas syringae* pv. *syringae*). (Courtesy J. Young)



Figure 13. Systemic symptoms on petioles and leaves of sweet cherry (*Pseudomonas syringae* pv. *morsprunorum*). (Courtesy D. Funk/A. Alvarez)



Figure 14. Blast stage on leaf, buds, and fruit of sweet cherry (*Pseudomonas syringae* pv. *syringae*). (Courtesy S. Thompson)



Figure 15. Dark, necrotic lesions on petioles of sweet cherry (*Pseudomonas syringae* pv. *syringae*). (Courtesy S. Thompson)



Figure 16. Sweet cherry exhibiting blast stage on young fruit. Note sunken centers of the lesions with water-soaked brown margins (*Pseudomonas syringae* pv. *syringae*). (Courtesy S. Thompson)



Figure 17. Cherry with internal systemic symptoms and bacterial ooze (*Pseudomonas syringae* pv. *morsprunorum*). (Courtesy D. Funk/A. Alvarez)



Figure 18. Cankers and bacterial ooze on young sweet cherry (*Pseudomonas syringae* pv. *syringae*). (Courtesy A. Jones/M. Shurtleff)



Figure 19. Gummosis on cherry twig (*Pseudomonas syringae* pv. *syringae*). (Courtesy S. Thompson)



Figure 20. Sweet cherry with numerous cankers on limbs (*Pseudomonas syringae* pv. *syringae*). (Courtesy M. Schroth)