OLIVE KNOT

Integrated Pest Management for Home Gardeners and Landscape Professionals

Olive knot disease on olive, *Olea europaea*, is distributed in olive-growing regions worldwide, and reports of the disease in California date back to the late 19th century. The disease is caused by *Pseudomonas savastanoi* pv. *savastanoi* (*Psv*), a bacterial pathogen that is spread short distances during the winter and spring rain events associated with California's Mediterranean climate. Consequently, in California, disease severity is greatest in the northern part of the state where heightened rainfall promotes disease development. Olive knot disease has become more common and serious during the past decade, in part due to increased plantings of the 'Manzanillo' olive, a highly susceptible cultivar, and the introduction of super high-density olive plantings for oil production, a system where mechanized cultural practices can promote disease development.

IDENTIFICATION

The characteristic symptom of infection is the development of galls, or "knots," at infection sites (Fig. 1). Galls are most commonly formed at leaf nodes (sites of bud development), due to infection of leaf scars by the bacterium; however, they also can be formed at other points of pathogen entry, such as pruning wounds or wounds caused by frost damage or hail. Excessive freeze damage increases disease severity even in regions characterized by lower rainfall. The olive knot bacterium produces plant growth regulators at infection sites resulting in plant tissue proliferation and gall development. Though galls typically form on stems and twigs, galls also have been observed on leaves and fruit. During rain events, bacterial ooze might form on the surface of galls; this ooze is infective and can induce disease when transmitted to uninfected plant parts.

DAMAGE

Galls produced as a result of infection by *Psv* can girdle and kill affected twigs (Fig 2). The death of infected shoots directly reduces yield; however, the disease also affects fruit size and quality. Flavor sensory tests have demonstrated that even trees with few galls can yield off-flavor fruit. The impact of the disease on yield, fruit size, and quality render olive knot of economic import to both commercial table olive growers and growers of olives for oil. Additionally, severe symptoms of olive knot detract from the aesthetics of olive trees used in commercial and private landscapes.

LIFE CYCLE

Psv survives both in gall tissues and as an epiphyte on twigs, leaves, and fruit (Fig. 3). The term "epiphyte" is derived from the Greek *–epi* (upon) and *–phyte* (plant), meaning "upon the plant." Because the pathogen survives better on rough bark surfaces than on foliage, pathogen populations are higher on twigs than on leaves. *Psv* populations on plant surfaces vary throughout the year, with populations increasing during the rainy season. Disease severity (i.e., the number of galls per tree) is directly related to the magnitude of the epiphytic pathogen population.

Both the epiphytic pathogen population and bacterial ooze emitted from galls can serve as primary inoculum (infectious propagules) for the development of new infections (Fig. 3). The pathogen can be transmitted both within a plant and to neighboring plants in wind-blown rain or over larger distances on contaminated pruning tools or infected nursery stock. The pathogen can infect the plant through natural openings that occur when the tree drops its leaves, flowers, or fruit, through wounds resulting from natural events such as frost injury or hail damage or by wounds caused by cultural practices such as pruning and harvesting (Fig. 3). Pruning wounds can remain susceptible to infection for at least 14 days. Leaf scars, however, are the most common points of pathogen entry and can remain susceptible to infection for up to 7 days after leaf drop (abscission).

Figure 1. Olive knot galls form on twigs at sites of infection by *Pseudomonas savastanoi*.

Figure 2. Gall tissue can girdle twigs and stems.

Although olives are evergreen and leaves drop throughout the year, the abscission rate in California is highest during the late spring. Consequently, the tree can be more susceptible to

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infection during spring rain events as a result of the heightened availability of fresh leaf scars serving as infection courts, or points of pathogen entry. Other factors enhancing leaf drop, such as frost damage or olive leaf spot disease, can increase vulnerability to infection by *Psv*. Generally infections by *Psv* on olive remain localized, resulting in gall formation at the infection site. Secondary galls, although rare, can be initiated by bacterial movement within the xylem vessels of the olive. These secondary galls typically form in close proximity to the primary gall, and the potential for a plant to support secondary gall development can vary by cultivar. Although all olive cultivars are susceptible to the pathogen, disease severity can vary by cultivar, and 1-year-old plants are more susceptible to infection than 3-year-old plants.

Because galls form only when the tree is growing, infections initiated during the winter won't become symptomatic until spring. This latent period between infection and symptom development offers yet another avenue of pathogen transmission, as sale of asymptomatic nursery stock can result in long-distance pathogen spread and introduction of the disease to uninfested landscapes or orchards. Plants containing asymptomatic infections might evade plant health inspectors and allow for international movement of the pathogen.

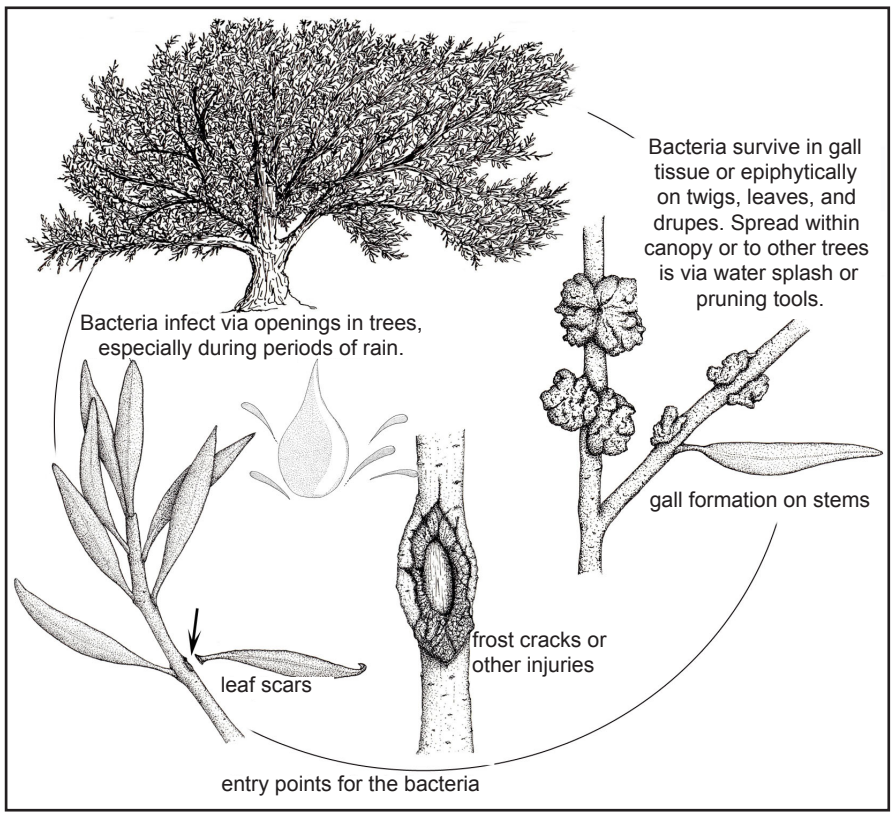

Figure 3. Olive knot disease life cycle.

MANAGEMENT

Although olive knot disease generally is caused by *Psv*, it is important to note that olives also can become infected by a related bacterium, *Pseudomonas savastanoi* pv. *nerii (Psvn)*. Both pathogens affect plants in the family Oleacae; however, *Psvn* is more commonly associated with knot formation on *Nerium oleander*, a disease referred to as oleander knot. While *Psvn* infects both oleander and olive, *Psv* infects only olive. The relative frequency of olive infections caused by *Psvn* in California is unknown. Effective management of both oleander knot and olive knot disease relies on reducing pathogen populations on the plant surface. Though commercial olive growers might utilize copper-based bacteriacides as a component of an integrated pest management program, products known to be effective aren't registered for use on backyard trees. Bacteriacidal compounds available to homeowners haven't been evaluated for efficacy in management of *Psv*. For the homeowner, a combination of cultural practices and sanitation is the most appropriate method of disease management.

Exclusion

For landscape plantings of olive, the primary defense against disease is pathogen exclusion. By planting disease-free nursery stock, a homeowner or commercial landscaper might avoid pathogen introduction into a landscape. When purchasing an olive tree, consider the potential for the plant to harbor latent infections. For example, purchasing a plant in winter heightens the potential for asymptomatic infections to evade observation. Gall formation can be complete by late spring, allowing for visual selection of uninfected plants.

Sanitation and Cultural Practices

Galls exude bacterial ooze during rain events; therefore, removing them from infected trees reduces the potential for disease spread. Because galls might form on small branches and twigs as well as large structural branches (scaffolds), tools ranging in size from small pruning shears to pruning saws might be needed to remove affected tissues from the tree. All tools should be routinely sterilized with a 10% bleach solution to prevent disease transmission both within and between trees. Galls shouldn't be removed during the winter and spring rainy season, because the resulting wounds can serve as new infection courts. Pruning wounds made in the dry summer months aren't susceptible to infection, thereby reducing the need to sanitize tools during summer pruning.

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