Wind Dissemination of Waterborne Erwinia amylovora from Pyrus to Pyracantha and Cotoneaster

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Fire blight has been a limiting factor in pear production in midwestern nurseries. Pear trees usually are grown for 2 seasons, then dug for storage and eventual sale. Branches visibly infected with fire blight are pruned regularly during the growing season. Removal of these branches should eliminate the source of inoculum by the end of the season, but fire blight usually reappears the following spring.

One possible explanation of this phenomenon is that the pathogen, *Erwinia amylovora* (Burr.) Winsl., continues to live in some other plants. If those plants did not show severe symptoms, the pathogen could remain undetected in the field and be carried back to pears the following spring.

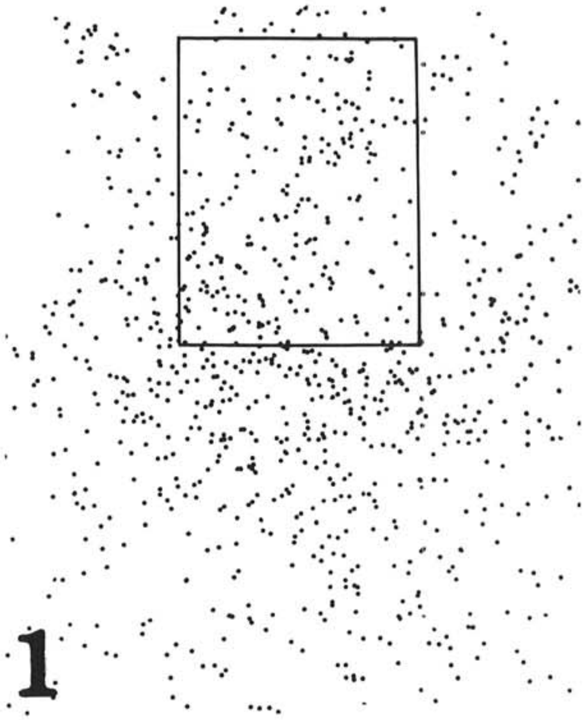
Many members of the Rosaceae have been reported susceptible to fire blight (3, 5, 6). Apples are the most common carrier, but are rarely grown near pears for that reason. Three other susceptible genera grown in midwestern nurseries, without fire blight as an obvious problem, are *Cotoneaster, Chaenomeles,* and *Pyracantha.*

Previous work (1) showed that fire blight could be spread from row to row of pears in the nursery by wind when sufficient moisture was present. If it spread to other susceptible genera in the same way this could account for its continuous presence in the field.

Field-grown 2-year-old *Pyrus communis* 'Bartlett', *Cotoneaster integerrima* Medic., *Chaenomeles japonica* Lindl., and *Pyracantha coccinea* 'Kasan' were planted in 6-inch clay pots with standard potting soil.

To determine the dispersal pattern of water from pear foliage, air was blown through pear trees sprayed with a dye made from food coloring and water. An oscillating fan with settings that produced wind speeds of 7 and 14 mph was placed 12 inches from the sprayed trees. The dispersed dye was caught on paper targets (42×36 inches) placed 40 inches from the sprayed trees and 52 inches from the fan. In several trials, the fan was operated for 5 min at 7 and 14 mph, both stationary and oscillating. Representative paper targets were photographed. To facilitate photography, individual droplets were covered with ¼-inch solid circles on the original paper targets.

Lyophilized cultures of *E. amylovora* were obtained from R. N. Goodman, University of Missouri. Bacteria grown on nutrient agar slants were prepared for inoculation by transferring them to tubes containing 5 ml of nutrient broth. Broth tubes were incubated at room temperature for 48 hr. Inoculum was then either sprayed on flowers or immature leaf surfaces with an aerosol sprayer or poured over plant surfaces that were then punctured with a dissecting needle. Inoculated



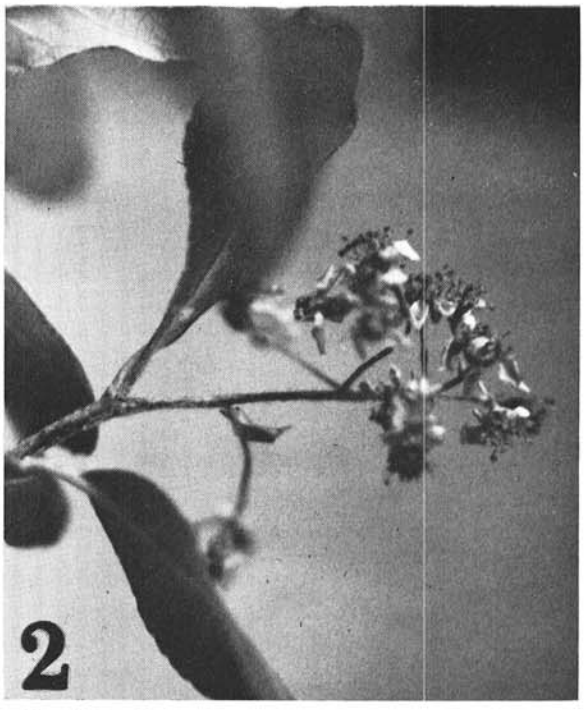


Fig. 1-2. 1) Pattern of waterdrops blown by a steady 14-mph wind (area enclosed by black square represents approximate extent of foliage on dye-covered tree). **2)** Fire blight symptoms in *Pyracantha* flowers.

plants were incubated for 48 hr under clear plastic bags.

Bacteria were disseminated from infected to healthy plants by simulating a rainstorm with an oscillating fan and a suspended hose with a two-hole fogging nozzle, using an arrangement similar to that described for water dispersal studies.

The results indicate that air movement of 7 and 14 mph is capable of moving water droplets at least 40 inches, the usual distance between nursery rows. Wind gusts of that magnitude are common during the growing season (1). The fan-blown dye produced spots on targets 1/64 to 1/4 inch in diam. At the greater wind speed, droplets were delivered higher than the source tree (Fig. 1). The patterns formed by the droplets indicate that trees or shrubs in adjacent rows would receive adequate moisture to produce infections if the droplets contained sufficient quantities of bacteria (4).

Inoculation of *Cotoneaster* and *Pyracantha* by puncturing succulent shoot tips produced infections that progressed only 1/2 inch down the shoots in *Cotoneaster*, but 3 to 4 inches in *Pyracantha*. Similar inoculations in *Chaenomeles* yielded no visible infections.

In preliminary trials where *Cotoneaster*, *Pyracantha*, and *Chaenomeles* were subjected to 14-mph winds for an hr or longer, then sprayed with inoculum, fire blight symptoms occasionally were found on shoot tips of *Cotoneaster* and *Pyracantha* and once in a flower of *Cotoneaster*. Symptoms were never found in *Chaenomeles*.

All attempts to inoculate *Pyracantha* and *Cotoneaster* foliage from infected pears by simulated rainstorms were negative, but the same method produced blackened calyxes and pedicels on several *Pyracantha* flowers within 5 days (Fig. 2). In 7 days, some *Cotoneaster* flowers also seemed infected. In both instances, about 50% of the open flowers eventually developed fire blight symptoms. Four obviously infected flowers from each type of shrub were placed in nutrient broth. Subsequently, this broth inoculated into pear shoots produced typical fire blight symptoms. Four flowers which did not seem infected were handled similarly, and produced no infections in pear.

Bacterial strands of the pathogen were present on all pear trees before transmission attempts (2), but none was found on *Cotoneaster* or *Pyracantha*.

Although simulated wind and rain moved the fire blight pathogen from infected pear trees to flowers on previously uninfected *Cotoneaster* and *Pyracantha*, and the resulting infections did spread downward into the shoots of shrubs, the lack of transmission of fire blight to foliage of *Cotoneaster* and *Pyracantha* reduces considerably the chance that this might occur in the nursery; however, infections were occasionally established in wind-damaged foliage of these shrubs when inoculum was sprayed upon them. Occurrence of this phenomenon in the field has not yet been demonstrated.

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