

Evaluation of Shot Hole Disease Development on Laurels and Efficacy of Control

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Common cherry laurel, *Prunus laurocerasus*, is an economically important broadleaf evergreen nursery and landscape plant. Otto Luyken, Schipkaensis, and Zabeliana are the primary cultivars in production. All of these cultivars are susceptible to shot-hole disease. Shot-hole disease is the most serious disease on cherry laurels in nursery production, as well as landscapes. In-nursery losses due to shot-hole can exceed 75%.

Symptoms of shot-hole disease range from small reddish spots with yellow halos in which the center of the spot drops out as the spot ages to larger, irregular, reddish-brown spots that are usually along the leaf margin where the affected area also drops out. The disease is most severe under wet conditions in mid- to late-summer. Overhead sprinkler irrigation and closely spaced plants favor disease development.

The primary causal pathogen of shot-hole disease was described as *Xanthomonas pruni*. This bacterium in association with another bacterium, *Xanthomonas campestris*, have been blamed for all the damage. Preliminary evidence suggests that shot-hole disease is not caused solely by bacteria but also by one to several fungal pathogens. Of the approximately 20 samples collected from Otto Luyken and Schipkaensis laurels in nursery production and in landscape installations, bacteria were recovered from only 8 leaf spot samples and of these approximately 5 were identified to be *Xanthomonas* sp. or *X. campestris*.

Currently in nursery production, laurels are being sprayed at least weekly with copper-based fungicides, copper hydroxide, or tribasic copper sulfate plus zinc sulfate and lime. Plants turn a bluish color from the repeated pesticide applications and still get shot-hole disease. Either the current controls are not effective or the control products are targeting the wrong causal pathogen.

The test conducted at the Center for Applied Nursery Research was designed to evaluate a copper-based fungicide and other fungicides for effectiveness in reducing the incidence of shot-hole disease on Otto Luyken laurels. The premise for the test was that if the causal pathogen was a bacterium, the copper-based fungicide would reduce disease because copper fungicides have activity against bacterial pathogens, whereas other non-copper fungicides do not.

Materials and Methods:

Ten single-plant replications were sprayed with copper hydroxide (Kocide 101), chlorothalonil (Daconil Ultrex), or thiophanate methyl (Cleary 3336WP) and mancozeb (Fore). Ten plants were not sprayed as a standard check treatment. Daconil and Kocide fungicides were applied every 10 days at the rate of 1.4 lb/100 gal and 1 lb/100 gal, respectively, and Cleary 3336 and Fore tank mix was applied on 14-21 day intervals at the rate of 1 lb/100 gal and 1.25 lb/100 gal, respectively, beginning in June 1997. Plants were spaced in full-sun and overhead sprinkler irrigated.

Plants were evaluated in July and individual leaves with spots were tagged to determine spot development over time. In July, the number of shot-hole infected leaves per plant and the number of shot-hole spots per leaf was recorded (Table 1). Plants were evaluated again in October and the number shot-hole leaf spots per shoot (each shoot averaged 20 leaves) was recorded. Also in October, the number of leaf spots that appeared to be related to fungal infection (other than symptoms attributed to shot-hole disease) was recorded (Table 1).

The number of shot-hole leaf spots per shoot on 10 single-plant replications of unsprayed *P. laurocerasus* cultivars Otto Luyken, Schipkaensis, and Zabeliana and *P. caroliniana* was recorded in October (Table 2). Other *P. laurocerasus* accessions from North Carolina State University Arboretum and the West Coast were screened for shot-hole leaf spot development within a shade house. The number of spots per plant was recorded in October and the plants were ranked according to their susceptibility to the disease using a 1-4 ranking scale where 1 = no leaf spots, 2 = less than 10 spots per plant, 3 = 10 to 20 spots per plant, and 4 = greater than 20 leaf spots per plant (Table 3).

Results:

Little shot-hole disease was observed on the spaced *P. laurocerasus* plants in full-sun (Table 1 and 2). By October, the number of shot-hole leaf spots on untreated Otto Luyken laurels was only 1.8 leaf spots per shoot (average of 20 leaves). The plants with the most shot-hole leaf spots were the ones treated every 7-10 days with copper hydroxide (Kocide 101). Treating plants with Daconil Ultrex or Cleary 3336 and Fore mix resulted in the least amount of shot-hole spots, but the number of spots was not significantly different from the untreated plants. Use of Daconil also significantly reduced the number of leaf spots and branch cankers caused by fungal (*Cytospora* and *Colletotrichum*) pathogens.

From this test, treating plants with Kocide 101 to control shot-hole leaf spot is not recommended. Kocide 101 is not labeled for use on cherry-laurel (*P. laurocerasus*) and some of the leaf spots observed may be due to a sensitivity of the laurel to the product (phytotoxicity) in this test. However, other studies have used copper hydroxide to reduce shot-hole leaf spot and did not report any phytotoxicity.

Of the *P. laurocerasus* cultivars evaluated, Otto Luyken was the most susceptible to shot-hole leaf spots (Table 2). The least susceptible cultivar was Schipkaensis which had a significantly lower number of spots per branch shoot (average of 20 leaves) than Otto Luyken. *Prunus caroliniana* also was less susceptible to infection than Otto Luyken.

Screening *P. laurocerasus* accessions from North Carolina State University Arboretum (NCSUA) and the West Coast did not produce any plant that was completely resistant to shot-hole leaf spot infection (Table 3). Infection of the plants within the shade house was greater than that seen on the Otto Luyken plants in full sun. Otto Luyken laurel from NCSUA was the most susceptible to disease with an average disease susceptibility ranking of 3.3 which corresponds to about 20 leaf spots per plant. Zabeliana, Mt. Vernon, Marble White and Forest Green cultivars had significantly less shot-hole leaf spots than Otto Luyken and may be considered for possible resistance breeding. However, Marble White was severely infected with powdery mildew making it less desirable for resistance breeding. The search for a shot-hole resistant *P. laurocerasus* laurel needs to be expanded.

Conclusions:

From the accumulated data this year, the cause of the shot-hole disease on cherry laurel appears to be due to both bacterial and fungal pathogens. Pathogenicity tests will be conducted this winter in the greenhouse to screen isolated organisms for their potential to cause shot-hole disease, and to determine which organism is causing the various symptoms found on laurel leaves throughout the growing season.

Fungicide applications of chlorothalonil or thiophanate methyl and mancozeb appear to provide control of the shot-hole disease. These fungicides are not labeled for use on bacterial pathogens and have limited activity against bacteria. This may suggest that the cause of the shot-hole leaf spot may be due to more fungal pathogens rather than bacterial. However, the disease pressure was too low in this test to adequately evaluate control products. Untreated plants did not have significantly more leaf spots than the fungicide-treated plants. More leaf spots and possible phytotoxicity were seen on the Kocide treated plants and therefore, I can not recommend Kocide (copper hydroxide) for shot-hole disease control. This test will be repeated in 1998, to evaluate more fungicide products and other copper formulations.

No *P. laurocerasus* accession in this test was found to be resistant to shot-hole disease. The cultivar Otto Luyken is the most susceptible cultivar to shot-hole as compared to Zabeliana and Schipkaensis. *Prunus caroliniana* had less leaf spot development than *P. laurocerasus* and may be a source of shot-hole disease resistance.

Table 1. Evaluation of efficacy of fungicides to control shot-hole leaf spot development on *P. laurocerasus* cv. Otto Luyken.

Fungicide treatment	Rate/ 100 gal	July		October	
		# of infected leaves/plant	# of Shot-hole spots/leaf	# of Shot-hole spots/shoot ¹	# of fungal leaf spots/shoot ²
Untreated		3.2 a ³	1.4 a	1.8 a	6.6 a
Daconil Ultrex	1.4 lb	1.5 a	1.3 a	0.3 a	0.2 b
Cleary 3336 + Fore	1 lb + 1.25 lb	1.1 a	0.6 a	1.2 a	2.9 ab
Kocide 101	1 lb	10.0 b	4.1 b	35.0 b	4.3 ab

¹ Each shoot averaged 20 leaves.

² Number of leaf spots that were not attributed to shot-hole and appears to be caused by a fungal pathogen.

³ Numbers followed by the same letter are not significantly different from each other using Tukey (HSD) pairwise comparison of means ($p=0.05$)

Table 2. Evaluation of untreated *P. caroliniana* and *P. laurocerasus* cultivars for shot-hole leaf spot development.

Plant species and cultivar	Number of Shot-hole leaf spots/ shoot (ave. 20 leaves)
<i>P. caroliniana</i>	0.4 a ¹
<i>P. laurocerasus</i> 'Schipkaensis'	0.9 a
<i>P. laurocerasus</i> 'Zabeliana'	1.7 ab
<i>P. laurocerasus</i> 'Otto Luyken'	1.8 b

¹ Numbers followed by the same letter are not significantly different from each other using Tukey (HSD) pairwise comparison of means ($p=0.05$)

Table 3. Evaluation of *Prunus laurocerasus* cultivars for shot-hole disease susceptibility

<i>Prunus laurocerasus</i> cultivar	Source ¹	Shot-hole disease susceptibility ranking ²
Zabeliana	NCSUA	2.0 a ³
Mt. Vernon	NCSUA	2.5 a
Marble White	NCSUA	2.5 a
Forest Green	NCSUA	2.5 a
Variagata	NCSUA	2.7 ab
Schipkaensis	NCSUA	2.6 ab
Schipkaensis	West Coast	2.7 ab
Otto Luyken	NCSUA	3.3 b

¹ NCSUA is the abbreviation for North Carolina State University Arboretum.

² Shot-hole disease susceptibility ranking scale of 1-4; where 1 = no leaf spots, 2 = <10 spots per plant, 3 = 10 to 20 spots per plant, and 4 = >20 leaf spots per plant.

³ Numbers followed by the same letter are not significantly different from each other using Tukey (HSD) pairwise comparison of means ($p=0.05$)