# Etiology and Control of Poinsettia Blight Caused by *Phytophthora nicotianae* var. *parasitica* and *P. drechsleri*

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**ABSTRACT**

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A blight of poinsettia (*Euphorbia pulcherrima*) leaves, bracts, and cyathia was shown to be caused by *Phytophthora nicotianae* var. *parasitica* and *P. drechsleri*. Leaf lesions, initially grayish brown, turned brown to black, expanded into irregular shapes, and elongated along veins. On bracts, lesions were purple to brown, spread very rapidly, and blighted large areas or entire bracts. Black lesions that expanded rapidly into rots were characteristic on cyathia. Fosetyl Al and ethazol were not effective at the rates tested for control of this disease. Metalaxyl as soil drenches at 6 or 12 mg a.i./960 $cm^3$ of potting medium provided excellent control of poinsettia blight.

A leaf, bract, and flower blight of poinsettia (*Euphorbia pulcherrima* Willd.) occurred sporadically during several Christmas seasons in nurseries on the island of Oahu, HI. Isolations from these yielded *Phytophthora nicotianae* Breda de Haan var. *parasitica* (Dastur) Waterh. (=*P. parasitica* Dastur) and *P. drechsleri* Tucker. In Florida, Engelhard and Ploetz (2) isolated *P. nicotianae* var. *parasitica* from wilting and dying potted poinsettia plants and demonstrated its pathogenicity to poinsettia by wound-inoculating crowns, stems, and roots. Although the natural occurrence of the foliar phase of this disease was not mentioned, they demonstrated the susceptibility of poinsettia leaves to *P. nicotianae* var. *parasitica*.

The bract and cyathium blights of poinsettia caused by *Phytophthora* spp. have the potential of being economically serious diseases and are apparently unreported. The occurrence of *P. drechsleri* in Hawaii appears to be a new report also.

The attractiveness and continuing popularity of poinsettia during the Christmas season creates a high seasonal demand for this crop. A potentially devastating disease such as Phytophthora blight poses a serious threat to production and marketability of this important commodity. Growers have lost as much as 20% of their crop to this disease. We report the symptomatology, pathogenicity of causal organisms, and control of this disease.

## MATERIALS AND METHODS

*Phytophthora nicotianae* var. *parasitica* and *P. drechsleri* were isolated from blighted poinsettia cultivars Gutbier V-14 Glory and Eckespoint C-35, respectively. Single-zoospore isolates P381 (*P. nicotianae* var. *parasitica*) and P449 (*P. drechsleri*) were the test isolates used throughout these studies.

**Culture.** Inoculum of *P. nicotianae* var. *parasitica* was prepared by growing cultures for 5 days at 25 C on 9 ml of VJA (100 ml of V-8 juice, 2 g of $CaCO_3$, 17 g of agar, and 900 ml of deionized water) in 60-mm petri dishes. Colonies were then covered with about 5 ml of sterilized, deionized water for 6 days for sporangial development. The liquid was then

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replaced with fresh, sterilized water and cultures were held at 16 C for 30 min to allow zoospore release.

Sporangia of *P. drechsleri* were prepared by a modification of the method of Kannaiyan et al (6). Twelve pieces (2 × 2 mm) of agar with mycelium from 3-day-old cultures grown on VJA at 28 C were placed in 60-mm petri dishes containing 5 ml of sterile 20% V-8 juice clarified by centrifugation. Two percent $CaCO_3$ was added to the V-8 juice before centrifugation. After 24 hr, the culture broth was discarded and the agar pieces were rinsed three times with sterilized, deionized water, then 5 ml of sterilized, deionized water was added to each dish. The dishes were incubated at 28 C for 3 days for sporangium formation. The liquid was then replaced with fresh, sterilized water and the dishes were held at 20 C for 3 hr for induction of zoospores.

**Pathogenicity.** Poinsettia cultivar Gutbier V-14 Glory was used in all tests. Flowering plants were sprayed with an atomizer to runoff with zoospore suspensions at $1 \times 10^3$ zoospores of *P. nicotianae* var. *parasitica* or *P. drechsleri* per milliliter. Inoculated plants were kept in moisture chambers for 24 hr at about 24 C in the laboratory, then returned to greenhouse benches to allow disease development. These inoculation and incubation procedures were used in all other tests.

**Control.** In all control studies, the number of leaves on nonflowering poinsettia plants was reduced to the 10 youngest fully expanded leaves per plant. Aqueous suspensions of fosetyl Al (Aliette 80WP), ethazol (Truban 30WP), and metalaxyl (Subdue 2E) were prepared at 200 μg a.i./g each. Each fungicide was applied as a drench at the rate of 12 mg a.i. per pot to three 15-cm-diameter pots, each containing 960 $cm^3$ of a 1:1 (v/v) mixture of Canadian peat and vermiculite. Plants were inoculated 1 wk after fungicide application.

In another experiment, metalaxyl also was applied at reduced rates of 0.6, 3, and 6 mg a.i. per pot for control of blight incited by *P. nicotianae* var. *parasitica* and at 6 mg a.i. per pot for control of *P. drechsleri* 1 wk before inoculations.

Efficacy of foliar applications was tested by applying fosetyl Al (2 mg a.i./g), ethazol (250 and 500 μg a.i./g), and metalaxyl (25, 50, and 100 μg a.i./g) to runoff, followed 1 wk later by inoculation with each of the two isolates. Results were recorded 2 or 3 days after inoculation, and all tests were repeated at least once.

## RESULTS

**Pathogenicity.** The blight symptoms produced by *P. nicotianae* var. *parasitica* and *P. drechsleri* on Gutbier V-14 Glory plants were virtually identical. Black lesions that expanded rapidly into rot were characteristic symptoms on cyathia. The rot also spread through the floral pedicel into green stems. Lesions spread from stems to bract petioles and laminae, causing bracts to wilt (Fig. 1A). Lesions initiated on bracts were 5–20 mm in diameter, were purple to purplish brown, and had diffuse margins (Fig. 1B). Coalescing lesions or rapidly expanding lesions developed into large, irregular shapes. Leaf lesions were paperlike and dry in texture, 2–15 mm in diameter, grayish brown at first, turning brown to black. Blight incited by *P. nicotianae* var. *parasitica* was uniformly severe on leaves, bracts, and cyathia, but blight caused by *P. drechsleri* on foliage was not as severe as on cyathia and bracts. Leaf and bract lesions appeared to expand rapidly in and close to veins.

Reisolation of each organism was accomplished by surface-sterilizing infected tissue with 0.05% sodium hypochlorite for 15 sec and placing tissue on water agar. The identity of each organism was confirmed by observing colony characteristics and sporangial morphology.

**Control.** Metalaxyl applied at 3–12 mg per pot gave outstanding control of blights caused by *P. nicotianae* var. *parasitica* (Tables 1 and 2); metalaxyl applied at 6 or 12 mg per pot controlled blights caused by *P. drechsleri*. No symptoms were seen on plants treated with metalaxyl at rates of 3 mg per pot or higher or on uninoculated controls. In contrast, more than 83% of the leaves of untreated plants or those treated with ethazol or fosetyl Al were blighted.

Metalaxyl sprayed directly on the foliage was not effective at 25 or 50 μg/g and only moderately effective at 100 μg/g. A few necrotic spots and tip burn of young leaves, symptoms of phytotoxicity, were occasionally seen on uninoculated plants sprayed with metalaxyl at 100

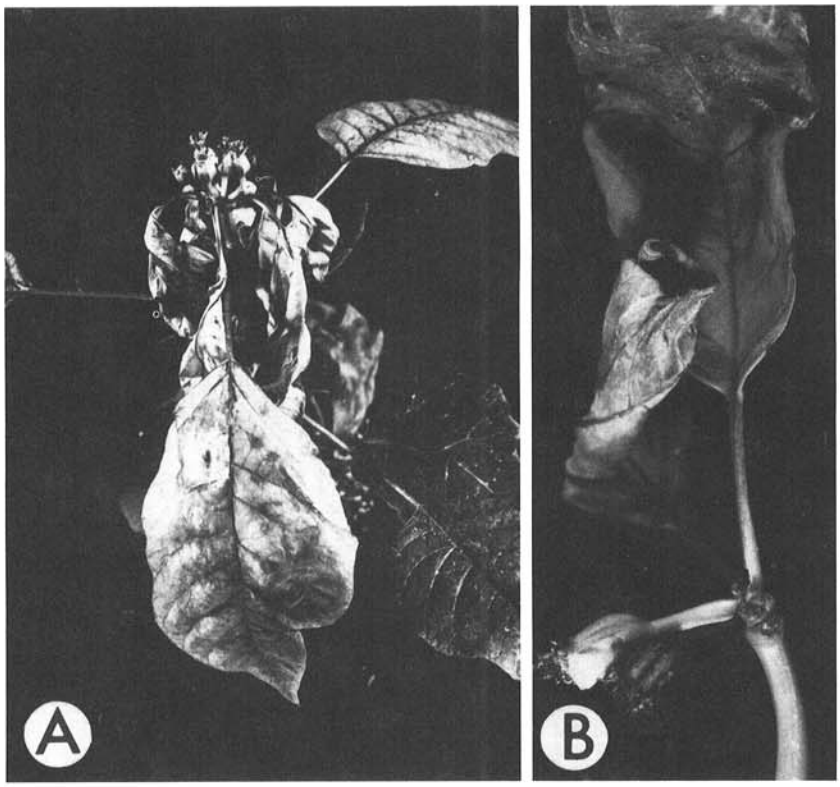


**Fig. 1.** Poinsettia blight caused by *Phytophthora drechsleri*. **(A)** Wilting of terminal shoot. **(B)** Necrosis of bracts and cyathium.

**Table 1.** Control of poinsettia blight caused by *Phytophthora* spp. with fungicide drenches

| | | *P. nicotianae* var. *parasitica* | | *P. drechsleri* | |
|---|---|---|---|---|---|
| Treatment | Rate (mg/pot)[a] | Infected leaves[b] (%) | Lesions/leaf[c] (no.) | Infected leaves (%) | Lesions/leaf (no.) |
| Uninoculated control | 0 | 0 | 0 | 0 | 0 |
| Metalaxyl | 12 | 0 | 0 | 0 | 0 |
| Ethazol | 12 | 100 | 23.6 ± 2.7 | 83 | 3.3 ± 0.7 |
| Fosetyl Al | 12 | 100 | 24.4 ± 2.3 | 83 | 4.1 ± 0.7 |
| Inoculated control | 0 | 100 | 25.9 ± 2.3 | 93 | 5.5 ± 0.7 |

[a] Each pot contained 960 $cm^3$ of 1:1 (v/v) mixture of Canadian peat and vermiculite.
[b] Based on 10 expanded leaves on each of three plants per treatment.
[c] Mean and standard error.

μg/g. These symptoms occurred regularly at 200 μg/g, and at 400 μg/g, symptoms were severe with chlorosis and scorching.

Ethazol and fosetyl Al were ineffective at the rates used in these studies, either as soil drenches (Table 1) or as sprays.

## DISCUSSION

Both *P. nicotianae* var. *parasitica* and *P. drechsleri* have wide host ranges (3,5,8). In Hawaii, *P. nicotianae* var. *parasitica* has been reported on pineapple, tomato, parsley, hibiscus, carnation (4), *Cordyline* (7), and papaya (1). There is no published account of *P. drechsleri* in Hawaii. It appears that *P. nicotianae* var. *parasitica* is more prevalent, has a wider host range, and is more likely than *P. drechsleri* to persist in inoculum reservoirs in Hawaii.

Severe outbreaks of poinsettia blight caused by these *Phytophthora* spp. have not occurred regularly, but destructive epidemics are possible during extended warm, wet periods. Because of high consumer demand during a limited holiday retail period, any factor reducing marketability of this plant is costly for the grower.

We have shown in these studies that metalaxyl applied as a soil drench provided excellent control of leaf, bract, and cyathium blights caused by *P. nicotianae* var. *parasitica* and *P. drechsleri*. This fungicide has been shown (2) to control poinsettia root rot caused by *P. nicotianae* var. *parasitica*. Proper nursery practices with supplementary applications of metalaxyl should control Phytophthora blights. Potted poinsettia plants in Hawaii are grown under semishade or in full sun, exposing these plants to conditions favorable to Phytophthora blights during wet periods. Growing plants in glass, fiberglass, or polyethylene greenhouses would eliminate or reduce rain and dew formation and also restrict movement of inoculum, thereby substantially decreasing possibilities for initiation of these diseases.

**Table 2.** Control of poinsettia blight caused by *Phytophthora* spp. with metalaxyl drenches

| Treatment | Rate (mg/pot)[a] | *P. nicotianae* var. *parasitica* | | *P. drechsleri* | |
|---|---|---|---|---|---|
| | | Infected leaves[b] (%) | Lesions/leaf[c] (no.) | Infected leaves (%) | Lesions/leaf (no.) |
| Uninoculated control | 0.0 | 0.0 | 0 | 0 | 0 |
| Metalaxyl | 0.6 | 46.7 | 1.5 ± 0.4 | ...[d] | ... |
| | 3.0 | 0.0 | 0 | ... | ... |
| | 6.0 | 0.0 | 0 | 0 | 0 |
| Inoculated control | 0.0 | 100.0 | 27.5 ± 2.1 | 100 | 8.0 ± 1.1 |

[a] Each pot contained 960 $cm^3$ of 1:1 (v/v) mixture of Canadian peat and vermiculite.
[b] Based on 10 expanded leaves on each of three plants per treatment.
[c] Mean and standard error.
[d] Not tested.

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