

Verticillium albo-atrum on *Ceanothus* in a California Forest

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ABSTRACT

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Verticillium albo-atrum (dark mycelial type) was found to be the cause of a lethal systemic xylem infection of *Ceanothus integerrimus* on a relatively cool coastal forest site in an area with no history of cultivation. This report is apparently the first for *Verticillium* wilt on *Ceanothus* spp., the first on natural forest vegetation in western North America, and only the second of *V. albo-atrum* in California.

In August 1981, dead and wilting plants of deer brush (*Ceanothus integerrimus* Hook. & Arn.), a common shrub of disturbed forest sites in northern California, were observed on a heavily logged site about 10 km inland from the town of Mendocino on the northern coast of California. No known agriculture has occurred within 4 km of the site. Prior to logging 5 yr earlier, the site was occupied primarily by Douglas-fir, redwood, tanoak, and alder. Scattered dead and wilting plants occurred throughout most of the logged area (about 125 ha). Most of the xylem of wilting plants showed reddish discoloration from below the ground into the small, leaf-bearing twigs, suggesting that a systemic infection may have been responsible for the mortality. No such symptoms or disease have been reported on *Ceanothus* previously. Thus, stems of wilting plants were collected for isolation of the causal agent, and inoculations were made to confirm pathogenicity.

MATERIALS AND METHODS

A species of *Verticillium* was consistently isolated from discolored xylem by incubating sections of surface-sterilized stem segments on moistened filter paper and transferring conidia produced on the sections or by placing the stem segments directly on water agar plates. A conidial suspension of this fungus was prepared for inoculation as described by Christen and Peaden (1). Ten large *Ceanothus* plants growing near the site where the disease was discovered

were inoculated in March 1982. Three branches (with diameters of <1 cm, about 1 cm, and 1–2 cm) on each plant were inoculated 1–2 m above the ground. About 0.2 ml of the conidial suspension (8×10^6 conidia per milliliter) was introduced into a slit that was cut to a depth of about one-third the diameter of the stem. Four control plants were treated similarly but injected with distilled water. All wounds were covered with masking tape. Six-week-old seedlings of alfalfa and cotton were inoculated in the greenhouse as described by Christen and Peaden (1).

RESULTS AND DISCUSSION

The fungus fit the description of *V. albo-atrum* Reinke & Berth. (4). It formed dark mycelium but no microsclerotia when cultured on prune-lactose agar (10), and it failed to grow at 30 C. It also formed verticillate conidiophores with pigmented bases on colonized stem segments incubated on moistened filter paper (9).

On the basis of xylem discoloration in inoculated stems, 27 of 30 stems were infected when examined 5 or 7 mo after inoculation. Xylem of inoculated stems was streaked red for 5–200 cm above and 0–100 cm below the point of inoculation. At the time of examination, only one inoculated stem had died and one had wilted. An incubation period longer than 5–7 mo or root inoculations may be required for substantial stem mortality. The fungus was readily reisolated from discolored xylem of stems. No vascular discoloration was evident in the stems of control plants.

Although *V. dahliae* Kleb. (microsclerotial form) is common in California, particularly on cultivated crops in warm regions, our discovery is apparently only the second report of *V. albo-atrum* sensu stricto in this state. The first report (3) was on glasshouse cucumbers at Salinas, near the relatively cool Pacific Coast. Likewise, our discovery was in a cool

coastal location, as would be expected for the dark mycelial form of the pathogen (8).

Evidently, wilt caused by *V. albo-atrum* or *V. dahliae* has not been reported previously on *Ceanothus* spp. (2,6). The host range of the *Ceanothus* pathogen is not known. In greenhouse inoculations of seedlings, the fungus was pathogenic on cotton but not alfalfa, indicating that the strain was distinct from that reported on alfalfa in Oregon and Washington (1).

Examination of the literature indicates that *V. albo-atrum* is extremely rare in wildland forests (5,7,8). The discovery of *Verticillium* wilt on a native host in an area with no known history of cultivation might indicate that *V. albo-atrum* is native to the relatively cool coastal forests of California. However, we have looked beyond the vicinity of the discovery without detecting the fungus in *Ceanothus* or other plants. It is possible that the pathogen was introduced on plant material; for instance, *Cannabis* spp. may have been grown illegally in the area. The susceptibility of *Cannabis* to the *Ceanothus* pathogen is not known, but a related crop plant, hop (*Humulus lupulus* L.), is highly susceptible to *V. albo-atrum* (4).

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