Cephalosporium wilt of Cassia Surattensis in Hawaii

by
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ABSTRACT

A severe wilt of kolomona, *Cassia surattensis* found in Kauai was shown to be caused by *Cephalosporium* sp. Purpling of the leaflet venation, wilting, chlorosis, necrosis defoliation, twig dieback, reddish brown xylem discoloration and xylem plugging with tyloses and gum are characteristic symptoms. The time required for the pathogen to kill the host depends on plant age and moisture availability; small seedlings succumb in less than 10 weeks, large bushes four to five years old die in three to four months. A host range study involving 8 *Cassia* spp. and *Leucaena glauca* suggests specificity of *Cephalosporium* sp. to *C. surattensis*. Introduction of the disease to three localities of Kauai demonstrated the potentials of the pathogen as a promising biological control.

INTRODUCTION

Plant pathogens unquestionably play a role in nature in suppressing undesirable plant species (Wilson, 1969). Control of noxious weeds with plant pathogens are few but striking; e.g., bathurst bur, *Xanthium spinosum,* in Australia by *Colletotrichum xanthii* Halst. (Butler, 1951), persimmon, *Diospyros virginiana* by *Cephalosporium diospyri* Crandall, in Arkansas and Oklahoma (Wilson, 1965 & 1969), crofton weed, *Eupatorioum adenophorum* by *Cercospora eupatorii* Peck in Australia (Dodd, 1961).

Indiscriminate introduction to Hawaii of innumerable flowering plant species as ornamentals as early as the Eighteenth Century has contributed some of the major economic weed pests found today on the Hawaiian range. A favorable climate and absence of natural pests against introduced species in Hawaii provides ideal conditions for rapid increases of hardy, competitive plants. Lantana (*Lantana camara*), christmas berry (*Schinus terebinthifolius*), Hamakua pamakani *Eupatorium riparium*), and kolomona (*Cassia surattensis* syn. *C. glauca*) are among the ornamental introductions that have become serious weed pests that are difficult to control by mechanical or chemical means. Biological control of lantana with insects has a long history of successes and failures (Perkins, 1966). Successful use of *Cactoblastis cactorum* Berg and presumed associated pathogens in the control of prickly pear cactus in Hawaii (Fullaway, 1954) suggested the need for use of plant pathogens in biological control of weeds in the State.

In 1968 a Kauai rancher observed a dieback of *Cassia surattensis* which prompted these investigations (Trujillo & Obrero, 1972). The work presented here confirms the parasitic nature of the dieback and the potential of the pathogen as an excellent biological control agent of kolomona.

MATERIALS AND METHODS

Isolates of *Cephalosporium* sp. were obtained by burying small sections of discolored host xylem tissue in 2% water agar (WA). Four days after incubation at 28C hyphal tips were transferred to 10% V-8 juice agar at 28C. Spore suspension in sterile distilled water made from 10-day-old monosporic cultures placed on absorbent cotton were used for inoculations. Three-month-old seedlings of *C. surattensis,* grown in pasteurized soil under greenhouse conditions were inoculated by cutting the stem cortex to expose the xylem and by inserting a small section of absorbent cotton impregnated with spores of the pathogen in the cambial region. For controls, cotton soaked in sterile distilled water were used as inoculum. Spore suspensions were also drenched over the soil of plant with incised and non-incised root systems. For host range studies stem wound inoculations were made on *C. surattensis, C. fistula, C. sieberiana, C. alata, C. gaudichaudii, C. bicapsularis, C. javanica, C. javanica* x *C. fistula,* and *Leucaena glauca.* These plants obtained from commercial nurseries were of different ages. Inoculation tests were replicated four times and repeated twice.

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For field inoculations, three isolated areas were selected on the island of Kauai in areas with 100, 130, 190 cm average annual precipitation. These sites were approximately five miles from apparent center of origin of the disease, with a predominant population of *C. surattensis* ranging in age from three to five years with no visible symptoms of disease. Inoculations were made by cutting the stem cortex one foot from the soil and spraying a spore suspension of the pathogen on the exposed xylem. Less than 5% of the plants in each area were randomly inoculated.

RESULTS AND DISCUSSION

Xylem isolations consistently yielded a *Cephalosporium* sp. (Butler, 1951; Corda, 1939). Colonies on 10% V-8 juice agar were grayish black and slow growing, averaging less than 3 mm radial growth per day at 28 C. Hyphal growth from disease xylem tissue plated in 2% WA was poor and a minimum of 3 days of incubation at 28 C were needed before hyphae could be observed growing in the media. The pathogen is characterized by slender and simple conidiophores, hyaline 1-celled conidia, averaging 3.8 μ x 1.5 μ, which are produced successively at the tip of the conidiophore collecting in a drop. Hyphae in the media becomes dark with age.

Figure 1. Three month old C. surattensis seedlings showing wilting, necrosis and twig dieback 4 weeks after inoculation (left) non-inoculated healthy plants (right).

All wound inoculated *C. surattensis* seedlings showed disease symptoms in less than four weeks. Twigs wilted initially, later leaflets became chlorotic, followed by defoliation as twigs became necrotic and died (Fig. 1). Systematic infection of the xylem was characterized by pronounced reddish-brown vascular discoloration (Fig. 2). Microscopic observation of free hand sections of xylem stained with acid fuchsin revealed hyphae in the xylem vessels and plugging by tyloses and reddish gum. Xylem discoloration, extending more than 3 inches up and down from the point of inoculation, was noticeable in less than 2 weeks. This was evident when the cortex of the seedling showing initial wilting symptoms was removed. Severe foliar symptoms and total discoloration of the seedling xylem occurred in four to five weeks. The pathogen was reisolated and monosporic cultures were identical to original isolates.

In field inoculations disease symptoms, similar to those described for greenhouse inoculated plants, developed in less than two months and death of inoculated plants occurred in three to four months. Furthermore, an intense purpling of the leaflet venation of infected plants was noticed in the field. This symptom was not evident in greenhouse inoculations.

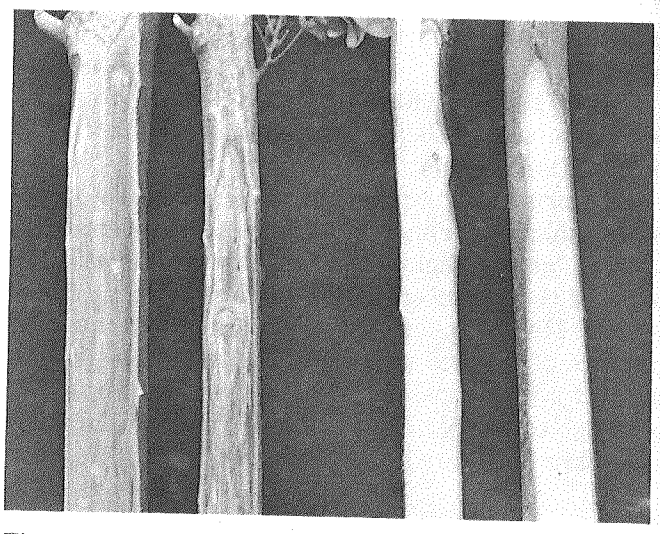

Figure 2. Internal symptoms of Cephalosporium wilt on 3 year old C. surattensis plants 3 months after inoculation. Inoculated stems (left) showing severe vascular discoloration; stems (right) non-inoculated healthy controls.

In the site with less than 100 cm of rainfall, all inoculated trees died in four months after inoculation, while at the other two sites with higher precipitation some plants were still alive after four months. Surveys of these areas showed natural spread of the disease to more than 50% and 100% of host population, six months and one year after inoculation respectively. The dry site, approximately 4 acres, with an average annual precipitation of 100 cm, showed 100% host plant mortality one year after introduction of the pathogen (Fig. 3). The other two sites, approximately 6 acres each, with average annual precipitation of 130 and 190 cm showed a number of apparently healthy plants (Fig. 4). Upon closer examination, however, the veins of young leaflets showed the intense purpling characteristics initial symptoms of diseased plants in the field, and the pathogen was readily isolated from the discolored xylem tissue. Three years later the original sites were surveyed. *C. surattensis* population had been reduced from 80% infestation to less than 1% in more than 30 acres of pasture land, but in its place lantana and other weed species were recorded as successors (Fig. 5).

Inoculation by drenching the soil with spores on injured roots resulted in 100% infection of host plants while no symptoms developed in controls with undisturbed root systems nor in wounded non-inoculated controls. Apparently, the pathogen is a wound invader and can infect the host only through wounds of the stem or roots. Host range studies showed negative results for *L. glauca* and all *Cassia* spp. tested except for *C. surattensis* which showed typical disease symptoms in less than two months. All other inoculated plants were kept in the greenhouse for more than one year without developing symptoms.

Failure to infect *L. glauca* and other *Cassia* sp. points to the high degree of host specificity of the pathogen. In this respect this pathogen differs from *C. diospyri* which apparently affects other members of the genus *Diospyros* (Crandall & Baker, 1950). The specificity and virulence of this *Cephalosporium* sp. makes it highly effective in control of *C. surattensis*.

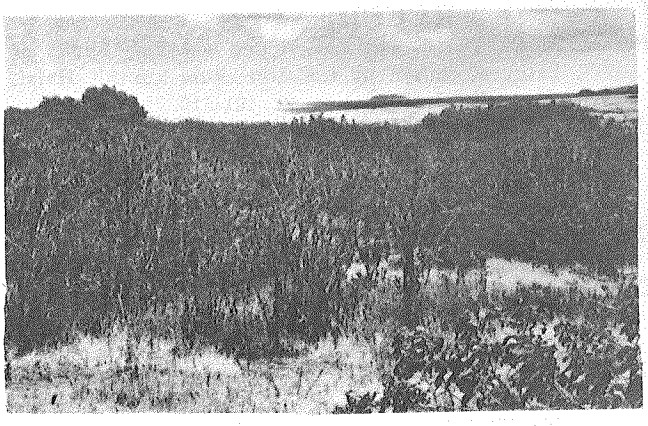

Figure 3. Kauai pasture in area with <100 annual rainfall showing 100% mortality of C surattensis one year after inoculation of <5% of the plants with Cephalosporium sp.

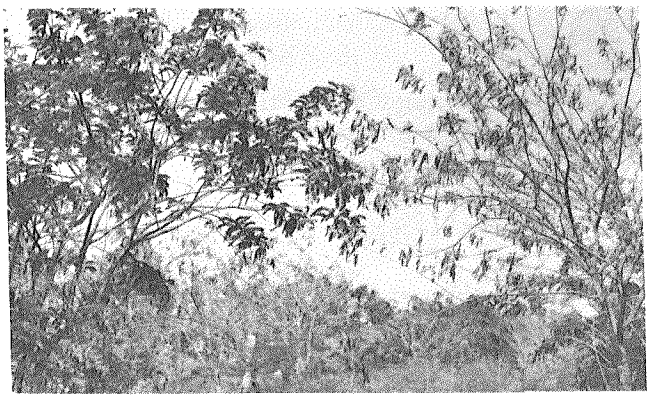

Figure 4. Kauai pasture in an area with 190 cm annual precipitation showing different stages of Cephalosporium wilt on C. surrattensis one year after initial inoculations.

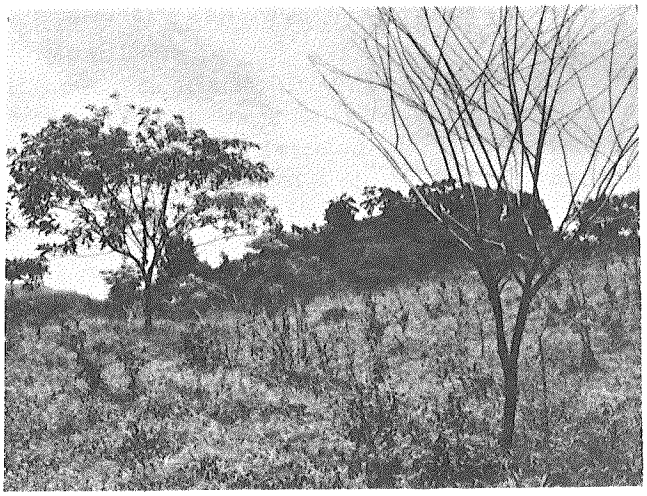

Figure 5. Kauai pasture located in an area with 190 cm of annual precipitation 3 years after initial inoculation of C. surattensis with Cephalosporium sp. Notice surviving plant on left showing initial disease symptoms.

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