

A New Leaf Spot of Pepper Caused by *Cladosporium oxysporum*

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ABSTRACT

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A previously undescribed leaf spot of pepper (*Capsicum annum*) in the Sultanate of Oman was found to be caused by *Cladosporium oxysporum*. Symptoms included irregular, brown leaf spots, 1-4 mm in diameter. The causal fungus was isolated and shown to be pathogenic by inoculation of attached and detached leaves of pepper under controlled conditions. Most cultivars tested were susceptible to the new leaf spot.

Pepper (*Capsicum annum* L.) is attacked by several fungi causing different leaf spots (5,6,10,13,14). Isolates of the genus *Cladosporium* were reported to cause leaf spot and fruit rot of pepper (1,2,11). *Cladosporium capsici* (Marchal & Steyaert) Kovachevsky caused circular to oval velvety spots up to 1.5 cm in diameter on the lower side of leaves of pepper in Bulgaria, Spain, Morocco, Congo, and Azores (8,9).

In March 1986, severe leaf spotting was observed on three cultivars of pepper, Kashmiri Long Red, Anaheim, and Hungarian Yellow Wax, in the Agricultural Research Farm, Salalah, Oman. During periods of high disease occurrence, air temperatures were 24-29 C and relative humidity was 77-98%. The spots were irregular, brown, 1-4 mm in diameter, and occurred on both sides of leaves. No infection was observed on fruits. The same disease was found in a survey of pepper fields conducted in the southern region of Oman during 1987, 1988, and 1989. Preliminary examinations with a light microscope indicated that the causal fungus may be a species of *Cladosporium*.

The objectives of this research were to isolate and identify the fungus associated with the observed leaf spotting and to reproduce the symptoms on healthy plants of pepper.

MATERIALS AND METHODS

Small portions of infected leaves (2-3 mm) collected from several pepper cultivations in the southern region of Oman were surface-disinfested in 0.5% aqueous NaOCl for 5 min, washed three times in sterile distilled water, carefully

dried between two sheets of filter paper, placed on potato-dextrose agar (PDA), and incubated at 24-28 C. Pure cultures obtained by single-spore transfer were used for pathogenicity tests. Spore suspensions were prepared by mixing conidia produced on PDA plates with sterile distilled water until a concentration of 100-200 spores per 2- μ l drop was achieved (verified with a lower-power microscope). This concentration gave approximately 10^4 spores per milliliter. The spore suspensions were sprayed to runoff on 4-wk-old seedlings of pepper cv. Kashmiri Long Red planted in plastic pots (15 cm diameter) containing a mixture of Floratorf 500 (peat moss sphagnum) and sandy loam soil (1:4, w/w). Four seedlings were planted in each pot. The inoculated plants were incubated in humidity chambers (50 \times 50 \times 70 cm) at 100% relative humidity, 24-28 C, for 24 hr and then transferred to a glasshouse. As an experimental control, seedlings were treated similarly except sterile distilled water was used instead of the spore suspension.

Healthy leaves (the fifth from the shoot tip) of mature plants of pepper cv. Kashmiri Long Red were collected from the Salalah Research Farm and used to confirm pathogenicity (3,4). Ten leaves were inoculated with the spore suspension and then floated in 9-cm-diameter petri dishes containing a solution of benzimidazole (100 μ g/ml). The experimental control included 10 other leaves washed with sterile distilled water and floated as above. All petri dishes were incubated at 26-28 C. Koch's postulates were repeated four times.

In another experiment, 4-wk-old seedlings and detached leaves of mature plants of five pepper cultivars (Kashmiri Long Red, Anaheim, El-paso, Hungarian Yellow Wax, and California Wonder) were inoculated as above. The fungus repeatedly isolated from diseased leaves

was sent for identification to the Commonwealth Agricultural Bureau/International Mycological Institute, Kew, England.

RESULTS

Laboratory examination of naturally and artificially infected leaves of pepper showed that the symptoms initially appeared on both sides of leaves as pinpoint chlorotic spots 6 days after inoculation. These spots enlarged and developed into irregular, brown lesions. The size of each individual lesion was variable, and some lesions were up to 4 mm in diameter by 10-12 days after inoculation. Within 15 days of inoculation, younger leaves were fully covered with spots and died. Infection on older leaves, however, was less severe. When the infected leaves were kept in a humid environment, a gray fungal growth developed in the centers of the spots.

The causal organism isolated repeatedly from infected leaves was identified as *C. oxysporum* Berk. & M. A. Curtis by D. W. Minter, Commonwealth Agricultural Bureau/International Mycological Institute, Kew, England. The culture has been deposited in the Herbarium (IMI309780).

C. oxysporum was pathogenic to four cultivars of pepper (Kashmiri Long Red, Anaheim, El-paso, and Hungarian Yellow Wax) in laboratory, glasshouse, and field evaluation. However, no infection occurred on cv. California Wonder.

DISCUSSION

This is the first report of the occurrence of a leaf spot caused by *C. oxysporum* on pepper in the Sultanate of Oman or other pepper-producing countries. The fungus has been described previously as a pathogen of citrus and *Eryngium foetidum* L. (7,12). Another species of *Cladosporium* previously was reported to attack pepper, causing a leaf spot with different color and size. Leaf spots caused by *C. capsici* are circular to oval velvety spots up to 1.5 cm in diameter (8,9), whereas the spots caused by *C. oxysporum* are irregular brown lesions up to 4 mm in diameter. Although some *Cladosporium* species were reported as causal agents of fruit rot of pepper (1,2,11), *C. oxysporum* was not found causing fruit rot in the southern region of Oman during 1987, 1988, and 1989.

The severity of this disease appears to be greatly influenced by environmental factors. Under humid conditions (77–98%) and at temperatures in the range of 24–29 C, the disease was widespread. On the other hand, the disease was restricted (lesions were fewer and smaller) in dry, hot weather.

C. oxysporum infected only cultivars of pungent pepper—Kashmiri Long Red, Anaheim, El-paso, and Hungarian Yellow Wax. California Wonder, a sweet pepper, was not infected. More studies, however, are needed on the resistance of pepper cultivars against *C. oxysporum*.

Mancozeb, which is usually sprayed on pepper for controlling *Cercospora* leaf spot in the Sultanate of Oman, has apparently minimized the incidence of pepper leaf spot caused by *C. oxysporum*.

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