

# A CYLINDROSPORIUM LEAF SPOT ON OAK<sup>1</sup>

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**Abstract.** A *Cylindrosporium* fungus was consistently associated with and isolated from circular leaf spots on *Quercus rubra*. It was examined in pure culture and on leaves by light and electron microscopy and identified as *C. quercus* Sorok. Growth of the fungus in culture was best at 27 °C; germination of conidia was best at 24-27 °C. Typical symptoms were produced on only 1 of 56 inoculated oak seedlings. This report is the first of *C. quercus* in Illinois and the first of a *Cylindrosporium* on *Q. rubra*.

**Résumé.** Un champignon, le *Cylindrosporium*, était toujours associé et isolé des taches de feuille sur le *Quercus rubra*. Il fut examiné dans des cultures et sur des feuilles par la microscopie à la lumière et électronique et identifié comme de *C. quercus* Sorok. La croissance du champignon dans la culture fut meilleure à 27 degrés C; la germination de conidies fut meilleure entre 24 et 27 degrés C. Les symptômes typiques furent produits sur seulement 1 des 56 semis de chênes inoculés. Ce rapport d'étude est le premier traitant de *C. quercus* dans l'Illinois et le premier traitant du *Cylindrosporium* sur le *Q. rubra*.

Leaf spot diseases on trees vary from those that are merely displeasing to those capable of killing trees, usually after two or more consecutive years of premature defoliation. Diseases that defoliate trees in midsummer and permit refoliation late in the growing season are especially harmful to tree health because stored carbohydrates are used inappropriately. Diseases that do not substantially reduce the photosynthetic area of the leaf are primarily of aesthetic importance.

*Cylindrosporium* is a fungus genus that has been associated with leaf spots on many woody plants, including *Shepherdia*, *Salix*, *Ulmus*, *Alnus*, *Corylus*, *Robinia*, *Rhus*, *Juglans*, *Morus*, *Ostrya*, *Prunus*, *Betula*, *Castanea*, *Fraxinus*, *Acer*, *Celtis*, *Carpinus*, and *Quercus* (10). Although associated with leaf lesions, proof of pathogenicity of the causal fungus has not been established for many tree genera. The leaf spot of cherry, caused by *C. lutescens* or *C. hiemalis* (teleomorphs are *Coccomyces* spp.), has, however, been studied extensively because it is destructive to fruit and may cause tree death (4,5).

In Illinois, *Cylindrosporium* spp. have been found on pin, shingle and California black oak (1,

7). In other states, *Cylindrosporium* spp. have been reported on white, bur, Oregon, and live oak (2, 9). The only report of *C. quercus* in the United States was on an oak species from Ohio (6). The objectives of this study were to describe the observed *Cylindrosporium* leaf spot on oaks, to characterize the associated fungus, and to prove pathogenicity of the fungus.

## Materials and Methods

The *Cylindrosporium* isolates used in this study were obtained in pure culture by placing small sections of diseased leaf tissue on potato dextrose agar (PDA) or by placing necrotic leaf lesions in moist chambers for 24 hours and transferring the fungus cirrhi onto PDA in culture dishes. The fungus isolates were then placed on four agar media (PDA, prune juice agar, corn meal agar, and V-8 juice agar) to determine the best medium for growth. Fungus isolates on agar media were also incubated at 18, 21, 24, and 27 °C to determine the optimum temperature for growth. Conidia from the isolates were incubated at the same temperatures to determine optimum temperature for spore germination.

The genus and species of the associated fungus were determined by examining the fruiting structures and the conidia. Freehand sections through the leaf lesion were examined with a light microscope. Specimens of diseased leaf tissue were also prepared for scanning electron microscopy and photographed. Characteristics of the fungus in culture were also observed.

Pathogenicity of the fungus was tested by inoculating potted seedlings of northern red (*Q. rubra*) and scarlet oak (*Q. coccinea*) with spore suspensions from PDA cultures or from acervuli on lesions of diseased leaves. The spores were brushed or sprayed onto injured and noninjured leaves and covered with plastic bags for 48 hours. Leaves were observed for lesion development in the greenhouse for 3 months.

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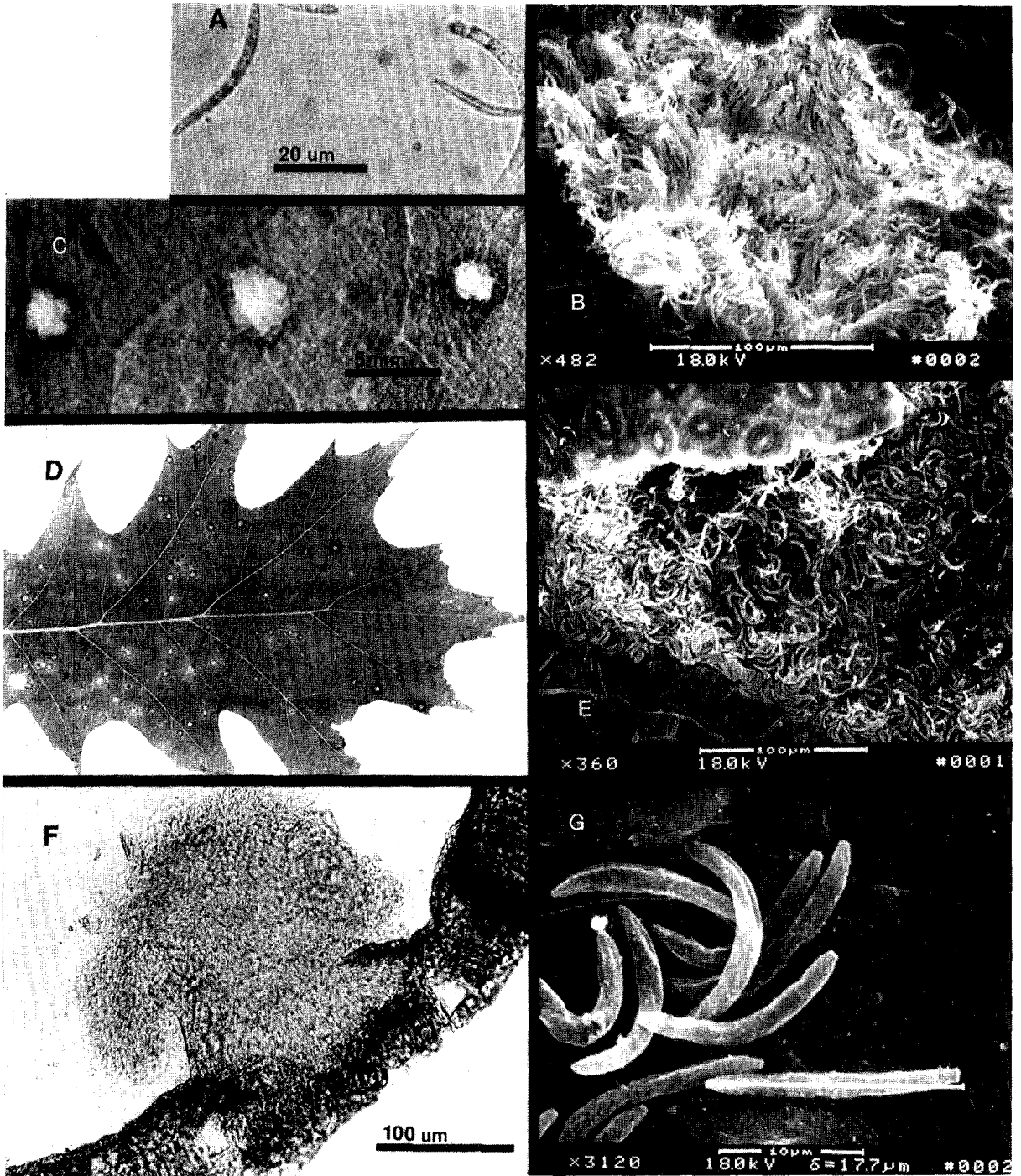


Figure 1. *Cylindrosporium quercus*. (A) Photomicrograph of conidia. (B) Scanning electron micrograph of acervulus. (C) Typical lesions. (D) Northern red oak leaf with typical lesions. (E) Scanning electron micrograph of acervulus and epidermal fragment forced up by emerging conidia. (F) Photomicrograph of cross section through the acervulus. (G) Scanning electron micrograph of conidia showing the flattened basal scar.

## Results and Discussion

The *Cylindrosporium* studied here was first collected from northern red oak in Urbana and Lisle, Illinois, in 1985. The disease was present on red oak in 1986, 1987, and 1988, and found at least once on English oak (*Q. rober*) and on bur oak (*Q. macrocarpa*). The lesions were first evident in July or August. Only on one red oak was it sufficiently serious to cause extensive defoliation on lower branches, an effect that resulted in branch dieback the following year.

The leaf spots associated with this fungus are dark brown when small and later became light tan with a dark margin. The spots are roughly circular in shape and may be surrounded with a yellowed halo (Fig. 1). Spots average 2.3 mm in diameter but are commonly as large as 3.5 mm and range up to 6 mm. They are spread randomly over the leaf surface and rarely coalesce. Each spot typically has one acervulus located in the center of the lesion on the abaxial surface. Occasionally spots have several acervuli. Acervuli appear yellow-orange in color, are pulvinate, subcuticular and erumpent and exude a gelatinous mass containing many conidia. Acervuli are 200-300  $\mu\text{m}$  in diameter. Conidiogenous cells are phialidic, cylindrical, unbranched, and hyaline. Conidia are hyaline and filiform or cylindrical, sometimes nearly falcate, 18-35 x 3-4  $\mu\text{m}$  and 0-3 septate. No sexual fruiting structures were observed.

The fungus isolated from oaks in Illinois belongs to the species *Cylindrosporium quercus* Sorok. (8, 9). It grows very slowly in culture but somewhat faster on PDA than on the other media tested. Growth averaged 12 mm per week at the optimum temperature of 27°C. Seventy percent of the conidia produced germ tubes within 24 hours at 24 and 27°C.

Unfortunately, pathogenicity of *C. quercus* on oak was not proven conclusively. Of the 56 trees inoculated throughout the study, only 1 northern red oak developed the characteristic leaf spot, which appeared 11 weeks after inoculation. This

tree developed six spots on three leaves, all with typical acervuli and conidia. No scarlet oaks developed disease symptoms.

A second leaf disease caused by the fungus *Tubakia dryina* (*Actinopelte dryina*) (3) is occasionally found associated with the *Cylindrosporium* lesions. It seems likely that *Cylindrosporium* is the primary invader, with *Tubakia* invading the stressed tissue near the *Cylindrosporium* lesion. The *Cylindrosporium* lesion then becomes greatly enlarged and contains numerous *Tubakia* fruiting structures.

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