SEPTORIA LEAF SPOT ON DOGWOODS

by Dan Neely and D.S. Nolte

Abstract. The fungus that frequently defoliates Siberian and yellow-twig dogwoods is identified as *Septoria cornicola.* Pathogenicity was confirmed in artificial inoculation trials, and environmental influences on fungal growth, sporulation, and spore germination were established.

Résumé. Le champignon qui défolie fréquemment les cornouillers de Sibérie et à rameux jaunes est identifié comme le *Septoria cornicola.* La pathogénèse a été confirmée par des essais d'innoculation artificielle, et l'influence environnementale sur la croissance fongique, la sporulation et la germination des spores a pu être établie.

A leaf-spotting disease causes August defoliation of *Cornus* spp. shrubs in midwestern USA. The fungus fruiting on the lesions is usually identified as a species of *Septoria.* The disease in Illinois is severe on Siberian (red-twig) dogwood, *Cornus alba siberica,* and on yellow-twig dogwood, *C. stolonifera flaviramea,* but occurs on other dogwoods including flowering dogwood, *C. florida.* Leaf lesions are rounded, 2-3 mm in diameter, frequently coalescing, are often bound by veins, and generally are more distinct on the upper leaf surface where they have a bright purple border (Fig. 1B). Leaf lesions are similar in appearance to those of dogwood anthracnose caused by a *Discula* sp. (2). However, *Septoria* does not cause twig and branch death. The lesions are larger than the tiny spots typical of the spot anthracnose disease of dogwood caused by *Elsinoe corni* (4).

Five species of *Septoria* have been reported on *Cornus* foliar lesions: *Septoria canadensis* Peck. (7), *S. cornicola* Desm. (3), *S. corni-maris* Saccardo (8), *S. cornina* Kuhnholt-Lordat (5), and *S. florida* Tehon & Daniels (10). The objectives of this study were to more fully characterize the etiology of the disease as it occurs in Illinois and to establish the pathogenicity of the causal organism.

Materials and Methods

Herbarium leaf specimens from the Illinois Natural History Survey pathogen collection (ILLS) were examined. The collection of *Cornus* leaf spots included species of *Ascochyta* (1 specimen), *Mycosphaerella* (1 specimen), *Pezicula* (1 specimen), *Phyllosticta* (1 specimen), and *Septoria* (20 specimens). Free-hand sections through the fungal fruiting bodies were made after softening by warming the lesion in lactophenol.

Isolates of the causal fungus were obtained from lesions on Siberian, yellow-twig, and flowering dogwood. Leaf tissue was surface sterilized in diluted 5.25% sodium hypochlorite (1:3) and placed on potato dextrose agar. Because of the extremely slow growth of the fungus on culture media, isolates were usually collected by transferring cirrhi from fruiting bodies on leaf lesions placed 24 hr earlier in a moist chamber. The morphology, growth, and germination characteristics of the isolates were observed on various agar media, under different temperature and light conditions.

Observations of natural infections were made on four Siberian and four yellow-twig dogwood plants in the Survey arboretum, 2 km south of Urbana, Illinois. The shrubs were 20 yr old and 2 m tall, with a history of severe defoliation. Disease incidence and severity were recorded on leaves from lower, middle and upper branches, and on proximal, mid-section, and distal portions of each branch at semi-weekly intervals, from mid-May through mid-August, 1985-1987.

Young plants from summer cuttings of Siberian dogwood growing in a greenhouse were artificially inoculated with isolates. Conidial suspensions were sprayed onto leaves with an atomizer or brushed onto the surface with or without prior injury by needle pricking, abrading with carborundum, or scorching with a soldering iron. Inoculated and non-inoculated shrubs were covered, unless otherwise noted, with a plastic bag for 2 days, and left in the greenhouse for 4 to 6 weeks.

Results

The fungus fruiting in the leaf lesions on field collections of *Cornus* spp., subsequently isolated from the margin of the lesions, is identified as *Septoria cornicola* Desm. The appearance of the

fungus was as follows: *Conidiomata* pycnidial, mostly epiphyllous, rarely amphigenous, appearing as dark pustules, scattered, subcuticular or more or less immersed in the palisade layer, separate, subglobose when young but often cupulate when mature (Fig. 1C), yellowish to pale brown, dehiscencing irregularly, 55-105 um diameter and 40-95 um high, wall 10-15 µ thick,

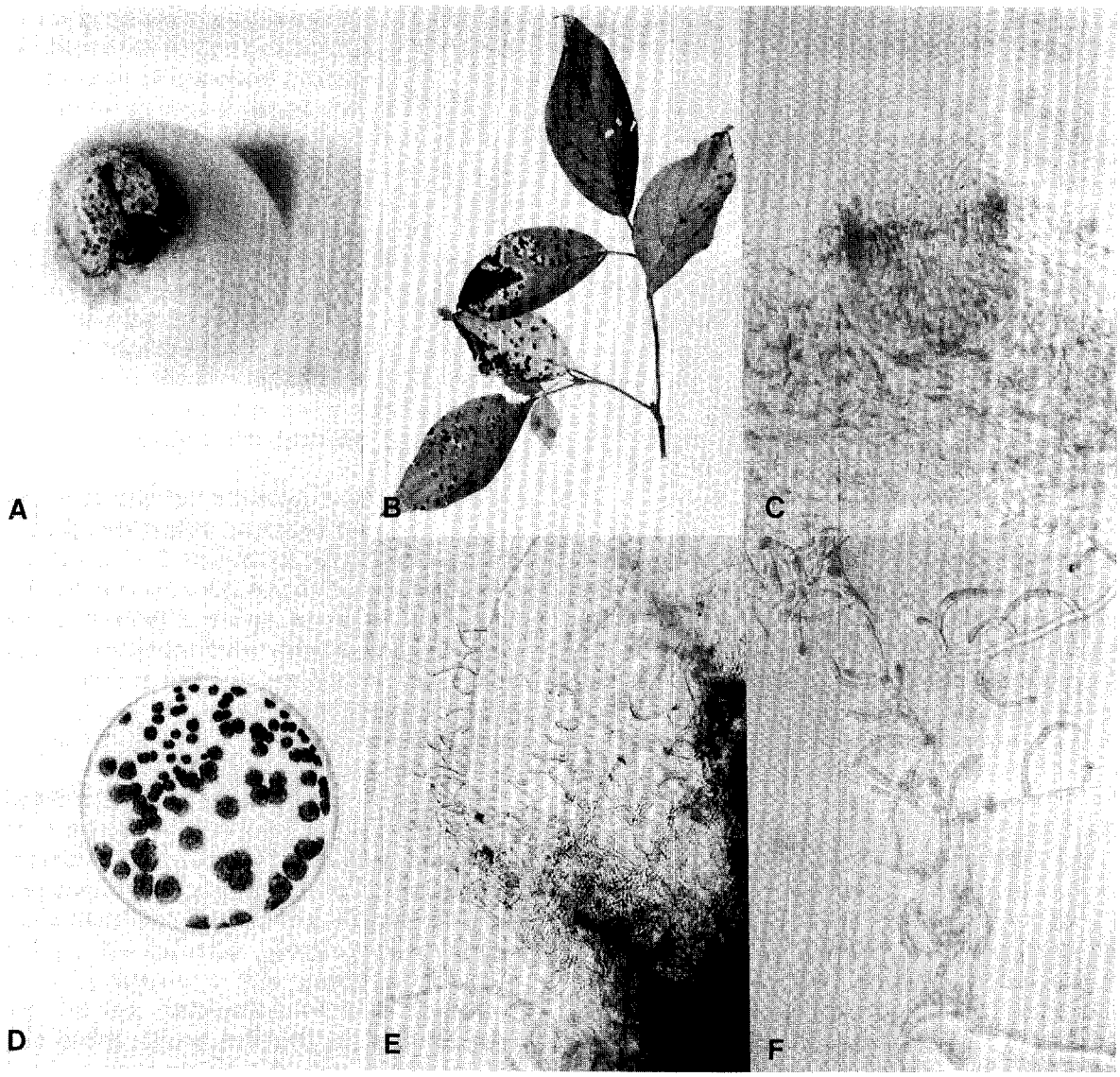

Figure 1. Lesions of *Septoria cornicola* are often first observed on fruit (A) with leaf lesions prominent in July and August (B). The fungus fruiting body is a cup-shaped pycnidium mostly observed on the upper leaf surface (C). On agar media the fungus is very slow growing, forming dense colonies with alternating chocolate and beige coloration (D). The fertile hyphae are indeterminate (E) and produce conidia that are hyaline, cylindrical, and more or less curved.

textura angularis. *Conidiogenous cells* holoblastic, indeterminate with a limited number of sympodial proliferations, discrete; hyaline ampulliform. *Conidia* hyaline, cylindric to obclavate, more or less curved (1-) 3-5 (-7) septate, truncate at base, apex rounded or slightly tapered, (20-) 30-50 (-65) x 2 3 µm. *Teleomorph* unknown.

Although characteristically slow growing, *S. cornicola* was cultured on oatmeal agar or PDA. A colony diameter growth rate of 4-8 mm/wk was sustained for only 3-6 wk. One-month-old colonies were circular, up to 3 cm in diameter, dense, and closely appressed with fimbrillate edges (Fig. 1D). Colonies consisted of alternating concentric bands of chocolate and beige mycelium, some bands with slightly flucculose appearance, and darkening with age. The underside of the colony on PDA was orange-yellow. Conidia were produced directly on the mycelium in culture (Fig. 1E, 1F). Pycnidia in culture were rare.

Temperature affected growth rate, sporulation, and spore germination. Radial growth on PDA in petri plates was optimal at 24 C (Fig. 2B), but averaged less than 1 cm in 28 days. Spore germination occurred from two or more cells per conidium within 24 hr. Over 75% of the conidia germinated on PDA over a temperature range of 18-30 C (Fig. 2A), with reduced germination on water agar at an optimal temperature of 21-24 C. Colonies from a single conidium sporulate within 3 days, with massive sporulation at 5 days (Fig. 2C). Young colonies on PDA produced the most spores at 27-30 C.

The first symptoms of disease on dogwood in the Survey arboretum appeared from mid-May to June 1. Some of the initial lesions were on the current year's fruit (Fig. 1A). Number of leaves with lesions (incidence) increased logarithmically from mid-June to mid-July (slightly later in 1986), with more infections on distal rather than on proximal leaves (Fig. 3A). Branches at all heights were affected. Multiple leaf infections (severity) with accompanying yellowing occurred from mid-July to mid-August (Fig. 3B). Again, branch height did not affect disease severity. Location of leaves on the branch did affect severity. Those leaves infected in July when they were distal on the indeterminate twigs of dogwood, which with passage of time became the middle leaves, were the first to become extensively colonized by the pathogen. Even the distal leaves that emerged late in the season were more severely affected than the proximal leaves. Defoliation occurred from July through late August and was especially severe on extensively colonized leaves (Fig. 3C).

An artificial inoculation technique that would consistently result in numerous lesions on leaves was not found. The four greenhouse trials in 1985 and the 10 greenhouse trials in 1986 produced results that varied from 3-6 lesions on 1-3 leaves on a single plant, to more than 12 lesions on all

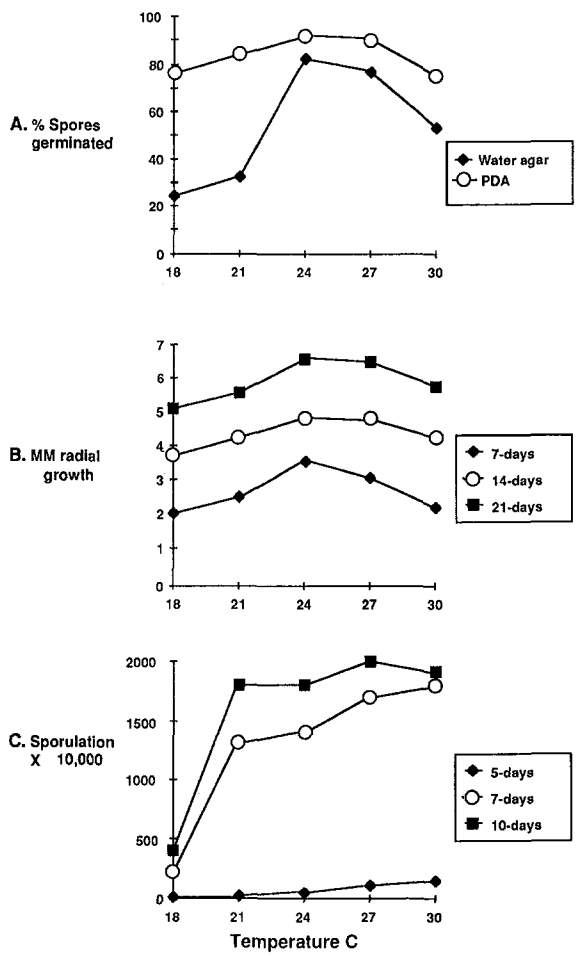

Figure 2. In laboratory culturing, temperature affects spore germination, colony radial growth, and colony sporulation of *Septoria cornicola*. Spore germination is somewhat better on PDA than on water agar with an optimum temperature of 24°C (A). Radial growth also is optimum at 24°C (B). Sporulation becomes profuse after 7 days at 27-30°C (C).

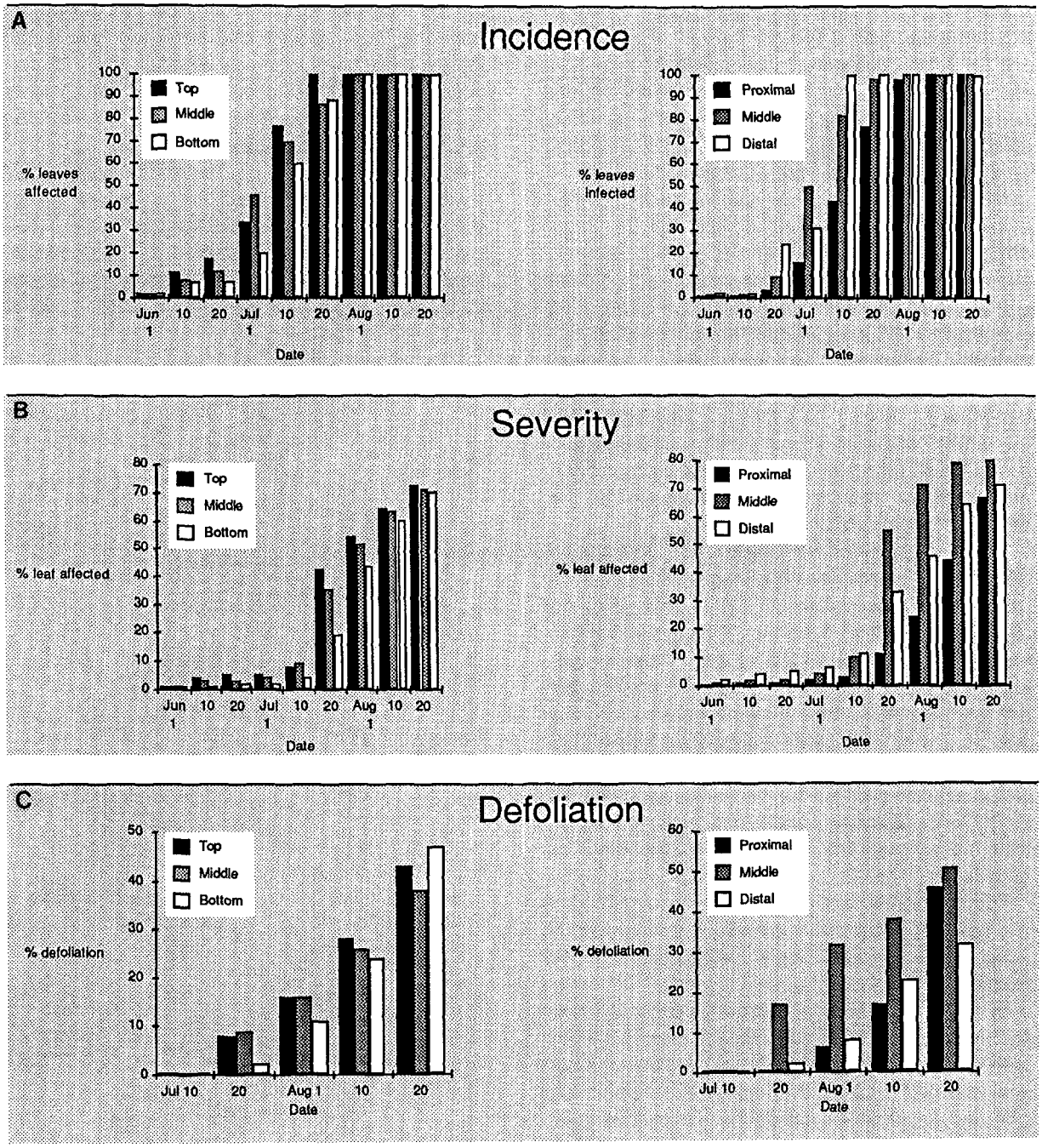

Figure 3. Leaf symptoms on Siberian and yellow twig dogwood in 1987. Disease incidence (leaves with one or more spots) was higher on upper and outer leaves than on lower and interior leaves (A). Disease severity (percentage of leaf discolored by leaf lesions) was not substantially affected by height on the plant, but was greater on middle and terminal leaves on the shoot than on the early-formed leaves (B). Defoliation occurred in late July and August and was closely associated with disease severity (C).

leaves of a plant. No relationship to leaf age was evident. The greenhouse lesions were typical of those seen in the field. Lesions formed in 14-25 days following inoculation and reisolation of the causal organism was readily accomplished. No inoculation technique was better than brushing a spore suspension on both sides of the leaf blade. Spores obtained from naturally infected leaves or fruit were not more virulent than spores produced on culture media. Inoculated leaves that remained moist in plastic bags for 6-12 hr were infected as heavily as those leaves kept bagged for 72 hr. Use of a mist chamber following inoculation was not beneficial. Concentrations of inoculum at 10^2 spores/ml resulted in lesions, but not as many lesions as when 10^5 or 10^6 spores/ml was used.

Discussion

The group of coleomycetous fungi that includes *Septoria* is undergoing taxonomic revision (9). This group formerly included fungi identified as species of *Cylindrosporium* and *Phleospora*. The demarcation between these genera is not clear. Traditionally, *Septoria* and *Phileospora* are regarded as producing pycnidia, and *Cylindrosporium* as producing acervuli. The conidiomata in *S. cornicola* are subglobose when young, but cupulate to acervular-like when mature, i.e., intermediate between pycnidial and acervular. Conidiogenesis, extensively used as a taxonomic character in recent studies on anamorphic fungi, apparently does not solve the problem of separating taxa of *Septoria*-like fungi (1). Conidiogenesis in *S. cornicola* is holoblastic sympodial.

Careful examination of overwintering dogwood plants did not reveal the teleomorph of *S. cornicola*. Neither did placement of dogwood leaf tissue on agar in a refrigerator at 8 C during the winter months. The published descriptions of the five species of *Septoria* reported on *Cornus* spp. are brief. Separation into species has been based primarily on the length of the conidia. *Septoria canadensis*, *S. corni-maris*, and *S. floridae* all have conidia of less than 35 µm in length; *S. cornina* has extremely variable conidia up to 48 µm long, with as many as 6 septa. Observations of conidia from leaf lesions, laboratory cultures, and herbarium specimens in Illinois, confirm the 35-45 µm length for placement in *S. cornicola*.

Disease development on dogwood is typical of fungal leaf spots. Leaf wetness is required for infection, but moisture is required for only a few hours. (No lesions were present on leaves through mid-July during the Illinois drought of 1988.) The leaves first infected are at the periphery of the plant, suggesting an external source of inoculum. Laboratory tests with the causal fungus support field observations during July and August that this is a warm-weather disease. The sigmoid incidence and severity curves are characteristic for polycyclic diseases. Septoria leaf spot on dogwood can be controlled with timely applications of protectant fungicides (6).

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