

## A Canker of Red Maples Associated With Oviposition by the Narrow-Winged Tree Cricket

G. S. Taylor and R. E. B. Moore

Plant pathologist, Department of Plant Pathology, and Technician II, Department of Entomology, The Connecticut Agricultural Experiment Station, Valley Laboratory, P.O. Box 248, Windsor, 06095.

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### ABSTRACT

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A bleeding, lens-shaped canker on nursery-grown and wild *Acer rubrum* in Connecticut was associated with oviposition wounds caused by the narrow-winged tree cricket, *Oecanthus angustipennis*. An unidentified

*Cryptosporiopsis* sp. was associated with cankered tissues and induced cankers in inoculated red maples.

A nursery planting of red maple (*Acer rubrum* L. selections Red Sunset and October Glory) near Suffield, CT, was severely cankered in early May 1977. In two plantings of ~200 trees each, cankers were present on trunks and lower branches of 90% of the trees. In one planting, 50 trees were girdled by either an individual canker or the overlapping of several cankers. Similar cankers were found on wild red maples at ~30 sites in central Connecticut and has been found on red maples in other states (George Hudler, Cornell University, Ithaca, NY 14853 *personal communication*).

In groups of wild trees, usually one or two had several cankers and none were found on neighboring trees. Cankers were not found on sugar maples or Norway maples growing nearby in five nursery areas or on sugar maples in 10 natural sites. The first evidence of canker formation was a brownish-black exudate that originated at a point, spread outward irregularly, and ran down the trunk. When external pressure was applied to affected areas, liquid was forced from a central point in the canker. Bark tissue, and the sapwood beneath it, was blackened in a narrow, lens-shaped area with the long axis vertical (Fig. 1). Often, in trees under 3 cm in diameter, a narrow area of recent sapwood was stained for up to 50 cm vertically above an individual canker. On some trees, cankers remained sunken and extended for more than 20 cm.

By late summer, nearly all nongirdling cankers were closing over with a strong callus formation, which sometimes raised the bark from the wood. By mid-September, callus completely closed the diseased area of many small cankers, but blackened sapwood remained exposed under the lifted bark of larger cankers (Fig. 2). The symptoms resemble those described for annual canker on sugar maple (10) and, in some cases, those described for bark canker on apples (2).

In late August and September, we noticed many freshly made, sometimes bleeding, small holes about 1 mm in diameter in the bark of the trunk or lower branches of most red maples examined in the nursery. Tree cricket eggs were found at the bottom of the holes, usually in contact with the cambium.

Cankers are known to be associated with tree cricket oviposition wounds on apples and raspberries (3,5,8). Gloyer and Fulton (3) noted oviposition by narrow-winged tree crickets caged on maple, but did not indicate the maple species or that a canker resulted.

We report here: the organisms isolated from cankers on red maple, the association of tree cricket oviposition wounds with the cankers, the identification of the particular tree cricket involved, and invasion of bark and wood of red maples by *Cryptosporiopsis* sp. isolated from naturally occurring cankers.

### MATERIALS AND METHODS

**Isolations.** During May 1977 and 1978, samples of cankered tissue with adjacent healthy tissue were excised from 10 affected nursery trees in Suffield and three in Granby, CT, and from eight affected wild trees in five towns in Connecticut and one in

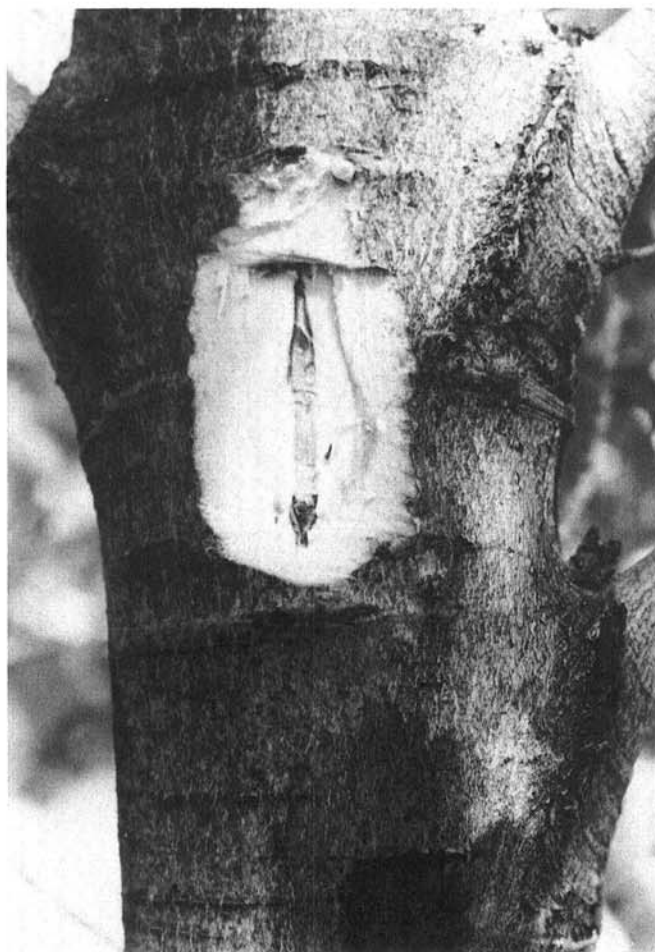


Fig. 1. Symptoms caused in a red maple trunk by *Cryptosporiopsis* sp. Note lens-shaped discoloration of sapwood beneath a canker that was bleeding like the one at the bottom of the photograph.

Massachusetts. In the laboratory a  $\sim 1\text{--}2\text{ cm}^2$  area of bark or wood tissue containing the margin of the discolored area was placed in .05% sodium hypochlorite for 30 sec and then rinsed in sterile distilled water. Approximately  $1\text{--}2\text{ mm}^2$  area of marginal tissue was excised with a flamed scalpel and transferred to potato-dextrose agar or malt agar. Hyphal tips of isolated fungi were transferred to obtain individual cultures. Bark surfaces were observed at  $\times 15$  in May, September, and October 1977, for types of fungus reproductive structures present. Spores were examined at  $\times 400$ .

**Association of oviposition wounds and cankers.** Close inspection of the bark over the center of many closing cankers in late summer 1977, often revealed a tree cricket oviposition wound of the previous year (Fig. 3). The percent of cankers with an oviposition hole in the bark over the cankered area was determined on 57 red maples in a commercial nursery (the trees were from 5–10 cm diameter at breast height [dbh] and in groups chosen at random in each of four plantings which totaled 2 hectares [ha]). Heights (meters) above the soil surface and compass-point orientations of the cankers were recorded for 13 consecutive trees approximately 3.05 m apart in one east-west linear row in the second plot.

**Identification of the tree cricket.** Adult tree crickets were collected from foliage in late August and examined under the microscope in the laboratory. Four females were confined in a 1,000-L flask with one or two branch segments each of red and sugar maples on two different occasions. After 4 days, oviposition

and egg morphology was observed.

**Inoculations.** One cankered nursery tree in Suffield and two healthy wild red maples nearby were inoculated 18 May 1977, by inserting infected bark tissue under a bark flap produced by a knife cut. Six knife cuts were not inoculated. Three wild red maples and three wild sugar maples in Windsor were inoculated 27 May 1977 by forcing  $1\text{ mm}^3$  of a PDA culture of a *Cryptosporiopsis* sp. into a wound made by stabbing a flamed dissecting needle through alcohol-swabbed bark. These were examined in late June for evidence of tissue invasion. Isolations were made from representative lesions. Wild red maples of 2.5 cm or less diameter were cut and brought to the laboratory on 25 November 1977. Segments approximately 30 cm long were cut with pruning shears and arranged in a test tube rack so that the lower portion of each segment rested on a plastic pan inserted through the rack. The pan was kept filled with tapwater. At a point  $\sim 20$  cm from the base, the surface of the red maple segment was swabbed with 95% ethyl alcohol and allowed to dry just before a 2-mm deep hole was drilled at the swabbed spot with an alcohol-dipped 1-mm diameter drill. A 1-mm cube of fungus culture on PDA was then inserted into the hole, with no further covering. The inocula were: four isolates of *Cryptosporiopsis* sp., one from each of two nursery trees and one from each of two wild trees; an unidentified *Fusarium* sp. isolated from a twig canker on a red maple sapling shipped from Oregon; and sterile agar. After 6 wk, the surface bark at points of inoculation was swabbed with 95% ethyl alcohol and sliced away before the underlying tissue was transferred to malt agar plates. Discoloration of bark or underlying wood was noted and length of the discolored area was measured upward from point of inoculation. There were four replications. Three red maples 3–6 cm dbh growing in each of two locations were inoculated in the above manner with the same organisms and sterile agar on 14 November 1977 and the presence or absence of an apparent canker was determined on 30 May 1978.

## RESULTS

**Isolations.** A fungus identified as *Cryptosporiopsis* sp. was isolated from inner bark or sapwood at lesion edges in 15 of 18 attempts from 14 red maples growing in two nurseries or in the



Fig. 2. Cankers (partially closed by callus formation) caused by *Cryptosporiopsis* sp. in red maple, December 1977.

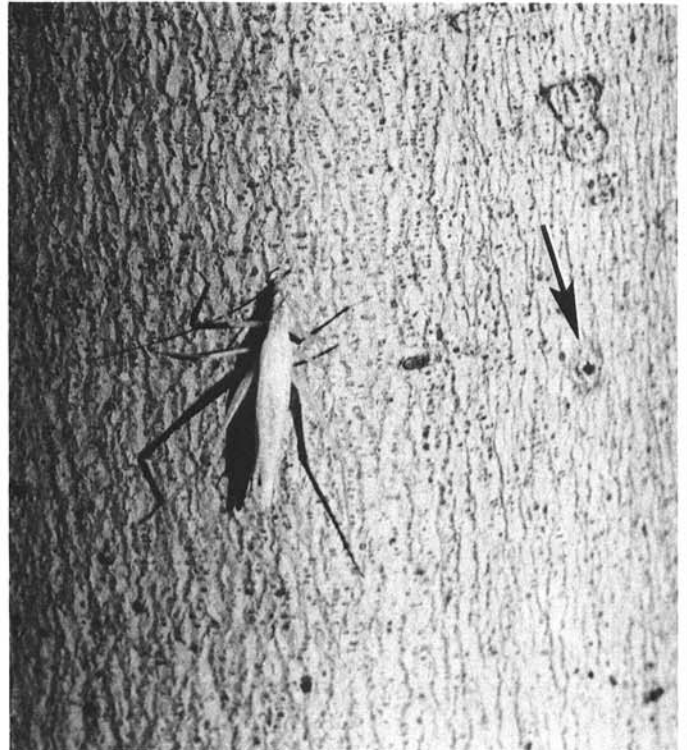


Fig. 3. Narrow-winged tree cricket on bark of red maple, October 1977. Note corked off oviposition wound at arrow.

wild. Outer bark over older cankered areas generally was infested with species of bacteria and fungi usually considered to be saprophytic; fruiting structures of *Phoma*, *Cytospora*, and *Diaporthe* frequently were present; occasionally *Sphaeropsis* spp. were detected, but none of these fungi were recovered from inner tissue at lesion edges.

**Association of oviposition wounds and cankers.** The percentages of cankers found with an oviposition hole near the center of the cankered area in four individual plots (57 trees, 232 cankers) were 81, 95, 92, and 100. Cankers with no visible hole sometimes were present at pruning wounds. Of 122 cankers on 13 trees in the second plot, 80 were on the southern side, 22 on the eastern side, and 10 each on the northern and western side. Forty-two were in the first meter above the ground, 69 in the second meter, and 11 in the third meter.

**Identification of the tree cricket.** Markings on the basal segments of the antennae were identical to those described as diagnostic for *Oecanthus angustipennis* (Fitch) the narrow-winged tree cricket (1,7). The insect is shown in Fig. 4.

Female crickets confined with segments of red and sugar maple produced oviposition holes in red maple only. Eggs were deposited either singly or in a V-shaped pair upward from the oviposition hole, typical of *O. angustipennis* (7).

**Inoculations.** Bark tissue was discolored up to 1 cm from the inoculation point on one nursery tree and five wild trees inoculated through a knife wound or needle puncture in May 1977. A typical canker did not develop, but *Cryptosporiopsis* was isolated from the

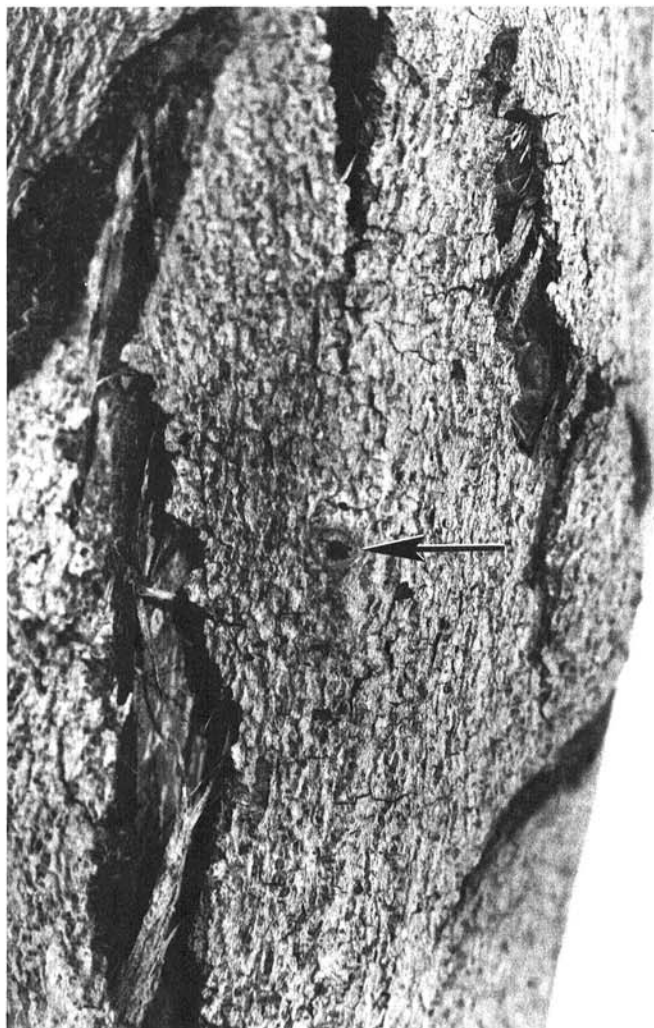


Fig. 4. Canker caused in red maple by *Cryptosporiopsis* sp. showing callus formation and an oviposition wound (arrow) caused by a narrow-winged tree cricket, November 1977. Probably the wound was the infection count.

diseased tissue 1 mm behind the advancing edge of the discoloration. Discoloration did not develop for more than a few millimeters on the three inoculated sugar maples or on the uninoculated knife wounds or needle punctures on red maples. Lesion length (millimeters) in bark or wood of four groups of red maple stems 6 wk after inoculation with *Cryptosporiopsis* were 16.8, 20, 20.5, and 22.8 vs 4.8 for the *Fusarium* and agar only. A lens-shaped area of sapwood was blue-stained as in the field, but the brownish-black stain associated with external bleeding symptoms did not appear. *Cryptosporiopsis* sp. was recovered from discolored bark and from stained sapwood up to 3 cm above the point of inoculation.

On six living trees inoculated with four isolates of *Cryptosporiopsis* in November 1977, 12 of the 24 inoculation points had developed visible cankers by 1 June 1978. Three of these cankers were bleeding and had the typical symptom pattern seen on naturally affected trees. The others were sunken in a lens-shaped area with callus forming at the edges. No canker developed at points inoculated with other fungi, at the six wounds that received agar alone, or at the six points that were only wounded.

## DISCUSSION

There is a relationship between bleeding, lens-shaped cankers found on red maple in Connecticut and oviposition wounds made by the narrow-winged tree cricket, *O. angustipennis*. We have isolated a *Cryptosporiopsis* sp. associated with the canker and this fungus is capable of inducing the canker when placed in wounds similar in size to, and made about the same time of year as, those made during oviposition by the narrow-winged tree cricket.

Although the signs of this disease are similar to those of annual canker (10), we believe it is a new disease for two reasons. First, annual canker is a disease primarily of sugar maples and we found no cankers on sugar maples growing near cankered red maples. Second, annual canker is caused by *Fusarium solani* and we did not find that fungus associated with cankers on red maples.

We were surprised that the pathogen was a *Cryptosporiopsis* sp. Hibben (4) found a *Myxosporium* sp. (*Cryptosporiopsis*) in bark of sugar maples 1 yr after injury by cold temperature, but healthy tissue was not invaded. *Myxosporium corticolum* Edgert. (*Cryptosporiopsis*) causes a long, narrow, sometimes girdling canker on apple (2), but is considered to be only weakly pathogenic, attacking only trees under stress. This type of long, narrow canker sometimes was present on the nursery-grown red maples we observed. Schoeneweiss (9) reported that sudden chilling (caused by rapidly moving cold fronts) resulted in canker formation on Tallhedge by a fungus which normally is nonpathogenic on that host. Kable et al (6) reported a similar occurrence on cherry.

Environmental stress could be a factor in development of the canker we found on red maples. More cankers occurred on nursery trees than on wild trees. Perhaps the open spacing of nursery-grown trees subjects them to more rapid temperature change. Wounding by the narrow-winged tree cricket may provide the infection court and subsequent stress may induce disease development. We did not determine whether the greater number of cankers on the southern and eastern exposure (80, 22 vs 10 and 10) was related to site preference by the tree cricket or to effects of wide temperature fluctuations on sunny winter days.

Finally, we suggest that because wounds resulting from oviposition by the narrow-winged tree cricket are small, and scattered with no tunneling of bark by nymphs, they may have been overlooked as a source of injury allowing entrance of pathogens causing cankers other than those already known on apple, raspberry, and red maple.

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