Camellias Need Not Have Die-Back

Harry Daunoy

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Since Harry Daunoy's article, "Camellias Need Not Have Dieback," appeared in Home Gardening last month, the following scientific papers and comments have come to our attention. Because die-back is the camellia's worst enemy in many sections, and because so little is known about it, we are glad to give space to as much information as we can gather. Additional comments and observations are invited.

**Stem Canker of Camellia**

**B. H. Davis and P. T. Pirone**

A canker disease of camellia (Camellia japonica L.) caused by the fungus *Glomerella cingulata* (Stone-may) Sp. & V. Schenk, has been under investigation in New Jersey for the past two years. Diseased specimens have also been received by the authors from Ohio, Pennsyl-

vania, and Texas during this period.

The same disease has been recorded previously by Shear and Wood (U. S. Dept. Agr. Bur. Pl. Ind. Bul. 252, 1913) on camellia leaves from North Carolina and by Thelma B. Post (Pl. Dia. Reporter 18, No. 8, 1934) on material submitted from Savannah, Georgia.

**Symptoms**

Wilting followed by blighting of the leaves on individual branches or the entire plant is the most striking symptom. Inconspicuous stem or branch cankers are associated with the leaf blighting. The amount of affected tissue involved in individual cankers is determinable only by cutting into the stem. Brown, discolored inner bark and wood are visible when the outer bark is scraped or cut away. Often the discolored wood extends beyond the bark discoloration.

Cankers are most common at the base of dead branch stubs.

Small, elongated black fruiting

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*Characterized by sudden and complete col-lapse of new growth at the onset of hot weather. This does not refer to slow de-foliation of twigs caused by scale injury or excessively alkaline soil.—Editor.*
structures (acervuli) are visible on the surface of old cankers. Pinkish masses of spores accumulate on these bodies when the stems are in a very humid atmosphere or when the cankers are protected from splashing water.

Susceptibility

Plants varying from rooted cuttings to 50 to 60 years have been found susceptible. Scars on stems of old plants are probably healed-over wounds following the removal of diseased branches or surgical treatment of fungus cankers.

Some varieties appear to be much more susceptible to the disease than others. Alba plena, an important commercial variety, is the most susceptible of those under observation. In addition, the following varieties were observed to be quite susceptible: Louise Centuroni, Sacco Rose, Sarah C. Hastie, Julia Drayton and Stranger. Although diseased specimens of the latter variety have not been found in commercial greenhouses, infection has been obtained readily by artificial inoculations. As a rule, the white-flowering varieties appear to be most susceptible.

Present Studies

Pure cultures of the fungus Glomerella cingulata were consistently obtained from several dozen stem canker isolations. Many inoculations, made by first wounding healthy stems and inserting bits of mycelium from a single spore isolate, have resulted in infection. On young stems, leaf wilting occurred within a month, and on older stems it was visible within three months after inoculation. In a few cases the artificially inoculated areas calloused over following the development of small cankers.

No infection occurred on unwounded stems despite the addition of the fungus, nor on wounded stems where no inoculum was applied. Leaf infections were obtained more readily when the tissues were wounded by needle-pricks prior to adding the fungus.

The disease apparently progresses slowly in the stems,—from 4 to 10 weeks are required for complete girdling and wilting, even on the current season's growth. In large branches or in the trunk, a much longer period is necessary.

Though rare, cuttings still in the rooting medium (sand) have been observed to be affected. Young plants in 2 to 3-inch pots are usually more heavily infected.

Cross inoculation studies with the same fungus isolated from apple and the camellia isolate were made. Although inoculations of the camellia fungus into apple twigs and of the apple isolate into camellia twigs were negative, those made on apple fruits and camellia leaves with both isolates resulted in infection. The apple isolate, however, produced more rapid decay of apple fruits and the camellia fungus speedier invasion of camellia leaves.

Severity of the Disease

The severity of the disease can only be roughly estimated inasmuch as it has been under observation in greenhouses where strict sanitary measures are practiced. Here only an occasional plant or portion of a plant is killed. Since the valuation of a flowering camellia plant is quite high, even a low percentage of infection represents considerable loss.

Control

Due to lack of material, no experiments on control have been conducted. The following suggestions will doubtless reduce losses: all plants should be watched carefully for blighting twigs. These should be removed as soon as detected. This is particularly true for the small shoots on large branches and the trunk. Cankers on the trunk and branches are not easily detected.

The fungus grows slowly in these tissues and considerable time may elapse between initial infection and the girdling. In the interim considerable inoculum may be produced.

Success with sanitary measures depends largely on the early detection of the cankers. When detected before complete girdling, surgical treatment may save the plant. All discolored tissues should be removed, but this practice may be difficult since discoloration may extend almost to the center of the stem. All wounds should be treated with a good wound dressing.

Gathering and burning all fallen leaves may help to eliminate a part of the inoculum.

In requesting copies of the papers referred to above (Shear and Wood and Post), we asked Dr. Freeman Weiss, Senior Pathologist at the Bureau of Plant Industry, U.S.D.A., for an unofficial comment on the subject. His letter is given below, followed by reprints of the two papers that we requested.

Dieback is a general term, a symptom rather than a specific disease. It is analogous to a sore throat, headache, or a fever among human subjects, that is, it may result from a variety of causes. Some may be biological or parasitic, others may be innate or physiological. Among plants of the citrus family, for instance, there are dieback diseases of practically identical aspect that may be caused by at least three different parasitic fungi and probably a larger number of adverse nutritional and environmental factors. A large number of fungi (or at least many different fungus names) have been associated with dieback diseases of plants, especially woody plants, and more particularly in the Southern States, because these organisms are mostly favored by warm weather.

Three such fungi are especially common and widely distributed, both geographically and on many different hosts. They are known to botanists as Diplodia, Gloeosporium, and Phomopsis; or in their mature or "perfect" stages as Physalospora, Glomerella, and Diaporthe, respectively. There are probably not nearly as many actually different species of these fungi as there are names that have been applied to them, but one or another of these organisms can be found on almost any kind of dead twig, fruit, or other plant part.

Certain races or strains of these fungi are actively parasitic, others appear to exist only as saprophytes, but even the parasitic strains can also live indefinitely on non-living materials. Thus it is impossible to conclude from the mere presence of these fungi on a plant specimen, say of dieback for example, that they are the actual cause of any damage.

Fungi of these types are not uncommonly present on camellias, and have been particularly noted on moribund plants, from which it is too often inferred that they are the cause of the diseased condition. There may be parasitic races, it is true, but ordinarily they can only be distinguished by artificially inoculating them to a healthy plant and reproducing a disease. And sometimes they are only weakly parasitic, and gain entrance as a result of special or temporary conditions. In nature such conditions may fortuitously occur, and the fungus becomes established and behaves parasitically, whereas under artificial conditions
the requisite factors for infection may be missed. One cannot be dogmatic about these questions. Mr. Daunoy may be quite right (and I have a high respect for his judgment in matters of plant nutrition) when he emphasizes the cultural factors that make for or against dieback in camellias; or on the other hand Mr. Cope may be justly impressed by the evidence that dieback is a parasitic disease. Dr. Chilton*, and also Dr. Edgerton*, have given a great deal of study to the question of parasitic races of fungi, Glomerella among others, and I would refer you to them for further particulars.

A dieback disease of *Camellia theae* was described in Ceylon by George Massée in 1899. He believed that a fungus, to which he gave the name *Colletotrichum camelliae*, was responsible. We now know that this fungus is identical with one recognized much earlier (by Berkeley in 1856) as a cause of apple fruit rot, and which was named *Gloeosporium fructigenum*. Since botanists base the ultimate name of a fungus upon the so-called perfect stage, this fungus is now known as *Glomerella cingulata*. In 1912 Dr. C. L. Shear, working in this laboratory, showed that this fungus was parasitic on camellia and tea, among many other plants, although he studied only foliage infections. Later Thelma Post, who was my assistant, isolated this fungus from natural dieback specimens, and showed by artificial inoculation of camellia that it could cause twig as well as leaf infections. During 1935-37 I saw a number of examples of twig blight (or dieback) and trunk cankers on camellias, and sometimes found the *Gloeosporium* stage of this fungus growing on them. In 1942 Davis and Pirone published their observations on a stem canker of greenhouse camellias which they showed was caused by this fungus, but there was really nothing new in their results.

In recent years another form of camellia dieback has been mentioned frequently in horticultural literature. On the basis of an observation by Dr. Fred A. Wood of the University of Florida, this disease was attributed to *Phomopsis camelliae*, a species of *Phomopsis*, but Dr. Supp* identified it as *Phomopsis dieback* has become almost a household word among camellia growers. It may well be that a strain of *Phomopsis* has attacked camellias with particular aggressiveness in some localities, but it certainly is not the only cause of dieback of these plants.

Without wishing to complicate this question more than it naturally is, I would add still another possible cause, namely the bacterial disease caused by *Pseudomonas syringae*. A shoot blight and leaf spot resulting from infection by this organism is known on a wide variety of plants, including all kinds of citrus, apple, pear, rose, lilac, and many herbaceous plants, as lama beans and cowpeas. It has not yet been reported positively on camellia, but about three years ago I received specimens of "dieback" of this plant from South Carolina that had every appearance of bacterial blight. I found bacteria present in quantity in the blighted tissue, but no *Phomopsis* or *Gloeosporium*. I had no facilities for identifying bacterial cultures, and I was unable to infect lilacs (a standard test for this organism) with these bacteria. However, I still believe that this was an example of bacterial blight of camellia for which this bacterial species was responsible. It may be that the type of dieback that Mr. Daunoy states is a sequel to overfertilization is really due, at least in part, to this bacterial disease, since it commonly attacks other kinds of plants when they are over-stimulated with nitrogenous fertilizer. It would also appear to be a quite different type of dieback from that associated with inanition, since this form attacks young shoots that are growing vigorously.

—Freeman Weiss

### Die-Back of Camellias*

*Thelma B. Post*

During the month of June several specimens of Camellia twigs showing die-back condition were received. The ends of the twigs and the terminal leaves were withered and black. On one specimen from Savannah, Georgia, received June 8, 1934, *Gloeosporium* (*Glomerella cingulata*) was fruiting abundantly on both twigs and leaves. An unidentified ascomycete with ascii containing eight two-celled, four guttulate, greenish, hylaline spores and club shaped paraphyses, was present on the twigs. Inoculations with the *Gloeosporium* showed that it was pathogenic, but the results of the test with the ascomycete were negative.

Anthracnose of Camellia caused by *Gloeosporium* has previously been reported from Mississippi, while *Glomerella cingulata* on this plant has been reported from South Carolina.

Although weather conditions (intense heat, following a period of rapid shoot growth) are believed to have influenced the occurrence of this die-back of Camellia, it seems probable that infection by the *Gloeosporium* was a contributing and perhaps a primary factor.

**Studies of fungous parasites belonging to the genus *Glomerella***

C. L. Shear and Anna K. Wood

*Thea japonica* (L.) Baill. (*Camellia*).

*Glomerella cingulata* (Stonem.) S. and v. S.

*Colletotrichum camelliae* Mass. Development on Leaves in Moist Chambers

On January 29 apparently normal, healthy leaves were taken from a greenhouse plant, the surfaces sterilized as usual, and the leaves placed in a sterile, moist chamber. They soon began to show a dark discoloration extending from the petiole up the midrib almost to the tip and finally became entirely discolored. Acervuli occurred on all the leaves, and fertile perithecia of *Glomerella* were also present but not abundant.

In February leaves of camellia, showing acervuli of *Gloeosporium* were received from South Carolina. Cultures were made from the conidia on these leaves. The fungus developed in the usual manner, but produced very few conidia and no distinct acervuli. The mycelium later became dark colored, and finally two perithecial forms were found; one appeared to be *Glomerella*, while the other produced large brown septate ascospores, indicating that the culture was impure. The *Glomerella*, however, was apparently identical with that on the leaves and presumably originated from the conidia used.
