

Necrotic Leaf Blotch of Golden Delicious—*Glomerella* Leaf Spot: A Resolution of Common Names

Common names have been used for hundreds of years to describe plant diseases. They are used widely by plant pathologists in communicating among themselves and with extension personnel, growers, and the public. They perform a useful function and help to avoid the use of scientific names of the pathogens involved. However, different common names given to the same disease can often lead to confusion, as can the same common name given to two diseases of different etiology. We believe that the latter is the case with two leaf spot diseases of apples referred to as necrotic leaf blotch. Although this problem has existed for more than 20 years, it was not a major concern until recently, when a serious leaf spot disease became widespread on the apple cultivar Gala in Brazil (13).

In the late 1950s and early 1960s, descriptions of a leaf spot (blotch) and associated defoliation of Golden Delicious apples (*Malus × domestica* Borkh.) began to appear in the scientific and popular literature in Europe. By the mid- to late 1960s, the disease was widespread and an important topic of discussion among professional fruit workers in the United States. The disease was given many common names, including Golden Delicious leaf blotch, necrotic leaf spot, physiological leaf spot, and necrotic leaf blotch. Speculation on its cause centered on *Alternaria* spp., air pollutants, mineral deficiencies, and environmental factors. A review article in 1973 summarized many of the early reports of the disease (9).

A series of studies (2,4,7,8,10,11,14) in the late 1960s and early 1970s provided a better description of the disease and determined factors related to its incidence and severity. The leaf blotch begins as a pale green area in the leaf, the same size as the final necrotic area, which turns chocolate brown over the next 2 to 4 h and light brown to tan with age. Blotches vary in size from 5 mm to over several centimeters in diameter and are usually bordered by larger veins. One to several blotches can occur on the same leaf. The midshoot leaves on growing terminals are affected most severely; however, once the terminal bud has set, terminal leaves also can be affected. Many severely affected leaves become chlorotic over the next 2 to 4 days and abscise. The disease occurs in distinct periods or waves and can result in up to 70% defoliation. This disease occurs throughout the world on Golden Delicious

and is described in the *Compendium of Apple and Pear Diseases* (6) but is not included in the APS list of common names of apple diseases.

No one has been able to ascribe a biotic cause to the disease (9,14). Abiotic causes such as air pollution and nutrient deficiencies also do not appear to be involved (9,12,14). The best evidence suggests that the disease is associated with a rapid synthesis of gibberellins which is triggered by a combination of environmental factors including low light intensity (8), cool temperatures (8,14), and high soil moisture (14).

The severity of necrotic leaf blotch can be reduced in the orchard by applying dithiocarbamate fungicides beginning about 6 weeks after petal fall and continuing every 2 weeks until 2 to 3 weeks before harvest (14). Combinations of chelated zinc materials and dithiocarbamate fungicides improve control (5).

In 1971, Taylor (15) described a disease, which he named necrotic leaf blotch and fruit rot of Golden Delicious apples, that was caused by a strain of the apple bitter rot fungus, *Glomerella cingulata* (Stoneman) Spauld. & H. Schrenk. Many of the symptoms and control of this disease are similar to necrotic leaf blotch of Golden Delicious, described above. Leaf spots associated with infections by *G. cingulata* begin as small red specks, which develop into irregular, light tan spots 3 to 12 mm in diameter. Severely affected leaves turn brown and abscise; less severely affected leaves become chlorotic and abscise in 2 to 4 weeks. The fungus can also become established in tissues of less susceptible cultivars, resulting in a dwarfing and crinkling of the leaves. The disease occurs in waves throughout the summer when conditions are favorable for disease development. Symptoms on fruit begin as faint, light brown specks which become dark brown, usually with a series of alternating brown and mahogany brown concentric rings as they enlarge. Only a few conidia are produced on the surface of these lesions, which distinguishes the disease from bitter rot caused by *Colletotrichum* spp. Ascospores produced in perithecia in overwintering leaves are the principal source of primary inoculum, and perithecia produced in leaf lesions in the orchard are responsible for secondary spread. The disease is controlled with ethylenebisdithiocarbamate fungicides applied during the summer. In his paper, Taylor (15) implied that the leaf

spot caused by *G. cingulata* was the same disease described above as necrotic leaf blotch of Golden Delicious, attributed to a physiological cause.

In the early 1980s, a previously undescribed leaf spot was observed on the cultivars Gala and Golden Delicious in Parana State in Brazil (13). Lesions begin as small, purple flecks that enlarge to irregular necrotic areas 3 to 10 mm in diameter. Severely affected leaves become chlorotic within 2 to 3 weeks after appearance of the symptoms and abscise. Waves of defoliation occur during the growing season and result in 75% or more defoliation by harvest. The disease differs from necrotic leaf blotch of Golden Delicious because younger leaves, as opposed to the midshoot leaves, are often first and most severely affected. *G. cingulata* can be observed fruiting in many lesions on leaves still attached to the tree. However, unlike the disease described by Taylor (15), fruit infections appear as small, irregular, tan, scablike lesions 2 to 4 mm in diameter and seldom develop into a rot. This further distinguishes the disease from bitter rot caused by *Colletotrichum* spp. Leite et al (13) named the disease "mancha foliar de *Glomerella*" (Glomerella leaf spot). Dithionon, mancozeb, and folpet, applied in the cover sprays, provide satisfactory control (1,3).

Because the leaf spot symptoms associated with the physiological disease necrotic leaf blotch of Golden Delicious and the disease caused by *G. cingulata* are somewhat similar, they are often confused by growers as well as by research and extension personnel. Part of this confusion arose because Taylor chose to refer to the disease caused by *G. cingulata* as necrotic leaf blotch. The evidence is compelling, however, that the etiologies of necrotic leaf blotch of Golden Delicious and the leaf blotch caused by *G. cingulata* are different. Consequently, we suggest that the physiological leaf spot found only on Golden Delicious and its bud sports should be referred to as necrotic leaf blotch of Golden Delicious and that the leaf spot caused by *G. cingulata* on Gala, Golden Delicious, and other cultivars should be referred to as Glomerella leaf spot. We propose the acceptance of necrotic leaf blotch of Golden Delicious as the name of the physiological disease, as opposed to other common names that have been used, because it is descriptive and used widely in the literature.

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Turner B. Sutton
E-mail: turner_sutton@ncsu.edu
*Department of Plant Pathology
North Carolina State University
Raleigh, NC 27695-7616*

Rosa Maria Sanhueza
E-mail: almazan@italnet.com.br
*EMBRAPA
Centro Nacional de Pesquisa
de Uva e Vinho
Bento Gonçalves-RS, Brazil*

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