

## BACTERIAL BLISTER SPOT OF APPLE IN ONTARIO

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### Abstract

This is the first report of bacterial blister spot of apple in Canada. The disease was found on the apple cultivar 'Mutsu' in Essex County and was characterized mostly by lesions with brown centers and dark-purple borders around the lenticels on the fruit and infrequently by elongated depressed areas on the twigs. *Pseudomonas syringae* was isolated from these lesions and its pathogenicity to apple was established.

### Introduction

Blister spot of apple was first reported from Missouri in 1916 and described by Rose (8) who found that it was a bacterial disease and named the causal organism *Pseudomonas papulans*. He also isolated these bacteria from the bark of apple trees that showed symptoms of a disease he described as rough bark or scurfy bark. In 1931, Lacey and Dowson (5) reported a bacterial canker on seedling trees of several new varieties of apple in England; the disease was characterized by horseshoe-shaped or circular cracks up to one inch in diameter, raised blisters, and elongated depressed areas in the bark, and dead buds. They found that the organism they isolated was identical with *P. papulans* Rose, the cause of scurfy bark in the United States. Roberts (7) also isolated *P. papulans* from early lesions associated with a disease he had described as target canker and was of the opinion that measles, target canker, and rough bark of apple might prove identical, since their early symptoms were similar. Smith (10) found that blister spot of apple had been reported from Missouri, Arkansas, Indiana, Pennsylvania, Virginia, and Illinois but not outside the United States. Although he was able to induce cankers on apple twigs by inoculation, he was of the opinion that under natural conditions, the disease occurred only on apple fruits. He further stated that *P. papulans* could not be assigned to a specific rank, as it was similar in morphological, cultural, physiological, and pathological characteristics to *P. syringae*, and he considered it to be only a strain of the latter species.

### Disease incidence, symptomatology, and isolations

During the summer and fall of 1968, it was noted that apples of the cultivar 'Mutsu', in an orchard in the Leamington areas of Essex County, Ontario, had conspicuous lesions around the lenticels (Fig. 1) that rendered them unmarketable. Almost every tree of 'Mutsu' was affected, but the condition was not found on other cultivars in the same orchard. A

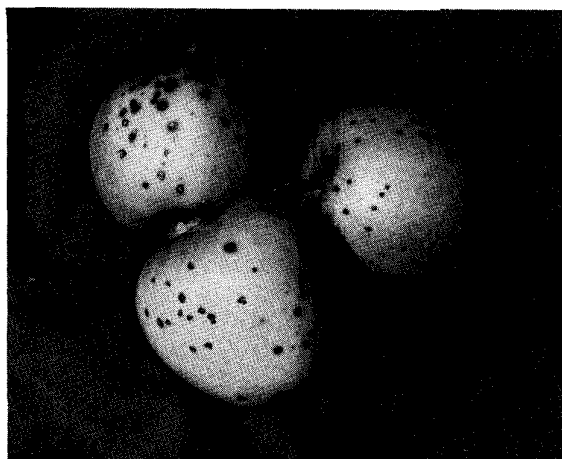


Figure 1. Blister spot on 'Mutsu' apple.

similar pattern of disease incidence was seen in two other orchards in Essex Co. with 'Mutsu'.

The lesions were always confined to the area around the lenticels. Incipient lesions appeared as water-soaked areas; mature ones were about 1-3 mm in diam., 1-2 mm deep, and had blistered brown centers with a dark-purple border. Some lesions were irregular in outline, appearing like minute infections of the apple scab fungus, *Venturia inaequalis* (Cke.) Wint., but mostly they were round. While the infections appeared to be uniform around the tree, the side of the fruit exposed to the outside had more spots. Twig infections were relatively infrequent and appeared as elongated, depressed areas, measuring 14-43 x 3-6 mm.

Microscopic examination of the fruit spots and twig cankers showed the association of bacteria with them. Isolations yielded bacteria that conformed in morphological, cultural, and biochemical characteristics to the description of *Pseudomonas syringae* van Hall as set out in Bergey's Manual of Determinative Bacteriology, 7th edition (2) with the exception

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that these isolates were lipolytic on Tween 80, according to the method of Sierra (2). These isolates produced round, dark-purple lesions 2-3 mm in diam. in 10-15 days when bacterial suspensions in sterile distilled water (75 Klett units) were inoculated into mature fruit of 'Mutsu' apples by needle-puncture. The bacteria were reisolated from such lesions. Inoculation of the non-wounded surface of the fruit was not successful. Leaf spots were produced on young leaves of 'Veecot' apricot (*Prunus armeniaca* L.) in 7 days when the plants were inoculated by atomizing the bacterial suspension under a pressure of 25 psi and held in a moist chamber for the following 48 hours. The last method has been used successfully to test the pathogenicity of a number of isolates of *Pseudomonas* occurring on stone fruits. These tests, it is thought, are sufficient to establish the pathogenicity of the apple isolates. Further work is under way to assess the factors contributing to the production of field symptoms.

## Discussion

Lenticel spots of apple have been ascribed to diverse causes. In New Zealand, Brook (4) isolated from pre-harvest lenticel spots on 'Sturmer' and 'Golden Delicious' apples nine different fungi, among which *Stemphylium botryosum* Wallr. and *Urocladium consortiale* (Thum.) Simmons were predominant. He presumed that they were pathogenic because the lenticel spots were controlled by pre-harvest sprays with fungicides. In France, Bondoux (1) attributed lenticel spots on 'Golden Delicious' and 'Reinette du Mans' apples to three pathogenic fungi, *Trichoseptoria fructigena* Maubl., *Cylindrocarpon mali* (Allesch) Wr. (stat. perf. *Nectria galligena* Bres.), and *Gloeosporium perennans* Zeller & Childs (*Pezizula malicorticis*). Miller and Rich (6) found grey to dark-brown lesions, 1-2 mm in diam. and 1 mm deep, around lenticels on 'McIntosh' apples in the valleys near New Haven, Connecticut. Because ozone is the air pollutant that most commonly causes damage to plants in Connecticut and also because the orchardist had noticed smog-like conditions in these valleys during periods of temperature inversions, they tested mature apples against ozone fumigation. Symptoms ranging from raised lenticels to small pits or larger depressed areas around lenticels occurred only when apples were exposed to ozone for at least 3 days; it should also be noted that the concentration of ozone used in their experimental setup was 10 times the highest recorded for ambient air in New Haven and also that such symptoms could not be induced on 'Golden Delicious', which is a parent of 'Mutsu'. Lenticular spotting on apples was also reported to be caused by ammonia fumes (3) and hence it is possible that such symptoms may be induced by a variety of phytotoxic fumes as well as

pathogenic micro-organisms. Because *P. syringae* was isolated from a large number of lenticel spots on apple fruits and from a few twig cankers, and because its pathogenicity was established by inoculation, the author is of the opinion that the disease reported here on the apple cultivar 'Mutsu' is not different from the blister spot of apple described by Rose (8) and Smith (10) in the United States.

This is the first report of bacterial blister spot of apple in Canada. So far as it can be ascertained by the author, this is also the first report of the fruit spot phase of this disease outside the United States.

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