

Bacterial Black Stem Rot on *Angelica acutiloba* Caused by *Xanthomonas campestris*

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(Received on December 17, 2001)

Soaked black rot symptom was observed on the stem of *Angelica acutiloba* from July to August 2000 at Kumsan, Chungnam in Korea. This disease usually occurred under humid and high temperature conditions. The lesions on the stem appeared as soft rot with brown elliptical spots, which developed into large black spots at a later stage. When the bacterial isolates from the diseased plants were inoculated onto healthy plants by artificial needle prick method, symptoms similar to that observed in the fields developed. According to the cultural characteristics and pathogenicity of the isolates on the host plant, the causal bacterium was identified as *Xanthomonas campestris*. This study proposed that the disease be named "bacterial black stem rot of *A. acutiloba*".

Keywords : *Angelica acutiloba*, bacterial black stem rot, *Xanthomonas campestris*.

Angelica acutiloba originated from northern Japan. It was introduced into Korea during the Japanese ruling era (Lee, 1994), and has since been cultivated for export to Japan. *Angelica* is an Umbelliferae, and there are several species under this genus including *A. gigas*, *A. acutiloba*, and *A. jaluana*. Bergapten, hydrothalid, and valerophenone have been known as important ingredients of *A. acutiloba*. *A. acutiloba* has been used as an oriental invigorating medicine which treats anemia, postpartum pains, and menstrual disorder (Baik, 1999).

Several diseases of *A. acutiloba*, mostly fungal diseases, have been reported such as leaf spot caused by *Phoma* sp. on *A. jaluana* and *Phoma* sp., *Cercosporina aralia-cordata*, and *Phyllosticta* sp. on *A. gigas*; brown leaf spot caused by *Ascochyta* sp.; and stem rot caused by *Rhizoctonia solani* (Lee et al., 1991). On *A. acutiloba*, stem rot caused by *Phoma* sp., sclerotinia rot by *Sclerotinia sclerotiorum*, powdery mildew by *Erysiphe heraclei*, and mosaic virus

disease have been reported (Lee et al., 1991). However, there has not been any report of bacterial disease on *A. acutiloba*.

Soaked black rot symptom on the stem of *A. acutiloba* was observed in the fields at Kumsan, Chungnam in 2000. This occurred under humid and high temperature conditions. Stems showing black rot were collected from the field. After a short disinfection with 70% ethanol, diseased plant tissue was placed in a micro-tube containing autoclaved water, and ground with a small pestle. Diluted solution was plated on nutrient agar medium. The plates were incubated at 28°C for 48 h. Single colony was isolated from the plate, diluted with 20% glycerol, and then stored at -70°C for further use.

For the pathogenicity test, the isolates were incubated for 48 h and diluted to 10⁸ cells/ml with autoclaved water. Pin-pricked stems of *A. acutiloba* were inoculated with the inoculum and placed at 28°C under humid condition. Water soaked lesion developed 5 days after inoculation on pin-pricked *A. acutiloba* stem. The lesion became black and grew larger with time (Fig. 1). This lesion was similar to natural symptoms that developed in the fields.

The isolates were identified as similar to that described by Schaad and Stall (1988). The bacteria, pathogenic to the stem of *A. acutiloba*, were Gram-negative, aerobic, produced yellow colony on nutrient-broth yeast extract agar (NBY) medium, showed lack of fluorescence on King' B (KB) medium, but did not produce mycelium or spore when tested based on Schaad's method (1988). These characteristics were the same as those of *Xanthomonas* as described by Schaad (1988). Thus, the bacteria were classified as *Xanthomonas*.

These bacteria produced viscous colonies on yeast extract-dextrose-CaCO₃ (YDC) medium and could grow at 35°C. Also, they hydrolyzed asculin, liquified gelatin, analyzed protein, and produced acid from arabinose, glucose, or mannose, while it did not produce urease (Table 2). These characteristics were identical to those of *Xanthomonas campestris* based on the description of Schaad (1988). Thus, these bacteria were classified as

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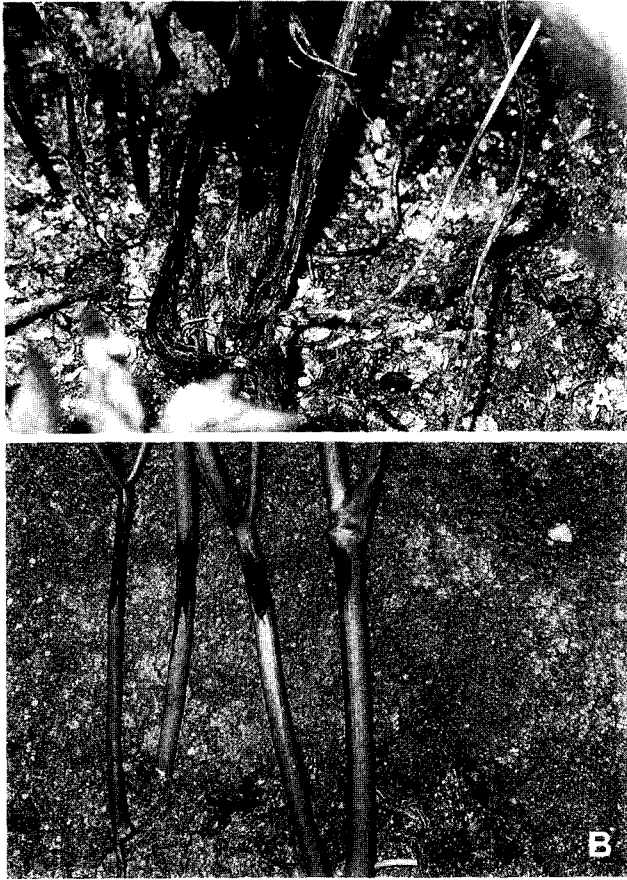


Fig. 1. Symptoms of black rot on *Angelica acutiloba* stem caused by *Xanthomonas campestris*. Typical symptoms developed on the crown in the field (A). Symptom observed after artificial pin-pricking inoculation (B).

Xanthomonas campestris.

There is no previous report of bacterial disease caused by *Xanthomonas campestris* on *A. acutiloba*. Thus, this study proposed that the disease be named as bacterial black stem rot of *Angelica acutiloba*.

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Table 1. Comparison of characteristics of the present bacterial isolates from diseased *Angelica acutiloba* stem with those of the genus *Xanthomonas*

Characteristics	Present isolates			<i>Xanthomonas</i> ^a
	1	2	3	
Gram stain	- ^b	-	-	-
Yellow colonies on NBY	+	+	+	+
Fluorescent pigment on KB	-	-	-	-
Anaerobic growth	-	-	-	-
Growth on D-1 agar	-	-	-	-

^aDetails of the genus *Xanthomonas* are described by Schaad (1988).

^bSymbols; +: positive reaction, -: negative reaction.

Table 2. Species identification of the present isolates from infected *Angelica acutiloba* stem

Characteristics	Present isolates			<i>Xanthomonas campestris</i> ^a
	1	2	3	
Mucoid growth on YDC	+ ^b	+	+	+
Growth at 35°C	+	+	+	+
Asculin hydrolysis	+	+	+	+
Gelatin liquefaction	+	-	+	V
Protein digestion	+	+	+	+
Urease production	-	-	-	-
Acid from:				
Arabinose	+	-	+	+
Glucose	+	+	+	+
Mannose	+	+	+	+

^aDetails of the genus *Xanthomonas* are described by Schaad and Stall (1988).

^bSymbols; +: positive reaction, -: negative reaction, V: variable.

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