Mycobiology 37(4) : 310-312 (2009)

Occurrence of Anthracnose on Highbush Blueberry Caused by *Colletotrichum* Species in Korea

Wan Gyu Kim*, Sung Kee Hong, Hyo Won Choi and Young Kee Lee

Agricultural Microbiology Division, National Academy of Agricultural Science, Rural Development Administration, Suwon 441-707, Korea

(Received November 30, 2009. Accepted December 7, 2009)

A total of 82 isolates of *Colletotrichum* species were obtained from anthracnose symptoms of highbush blueberry trees grown in the Gochang area of Korea during a disease survey in 2008. Out of the isolates, 75 were identified as *Colletotrichum gloeosporioides* and the others as *C. acutatum* based on their morphological and cultural characteristics. Twenty six of *C. gloeosporioides* isolates produced their teleomorph *Glomerella cingulata* in PDA culture. Three isolates of each *C. gloeosporioides* and *C. acutatum* caused anthracnose symptoms on the leaves by artificial inoculation, which were similar to what was observed in the orchards. Previously in Korea, only *C. gloeosporioides* has been reported as causing anthracnose in blueberries. This is the first report that *C. acutatum* causes anthracnose in the highbush blueberry in Korea.

KEYWORDS : Anthracnose, *Colletotrichum acutatum*, *Colletotrichum gloeosporioides*, Highbush blueberry, Pathogenicity

Blueberries (*Vaccinium* spp.) are widely grown in the world. Among the varieties of blueberries, the highbush blueberry (*Vaccinium corymbosum* L.) is the most commonly cultivated and has been introduced into Korea from foreign countries since 2,000. Recently, the plant has become a popular fruit tree in the Korea. However, a disease survey in 2008 revealed anthracnose symptoms frequently observed on leaves, fruits and stems of highbush blueberry trees grown in Gochang area. The incidence of the disease symptoms on the leaves reached as high as

Fig. 1. Anthracnose symptoms on highbush blueberry trees as observed in the orchards. A and B, brown to dark brown, circular or irregularly shaped lesions on the leaves; C, sunken, circular or irregular necrotic spots on the fruits; D, affected stems.

*Corresponding author <E-mail : kimwg5121@korea.kr>

30% in the orchards investigated, and less than 5% on the fruits and stems. The symptoms appeared as brown to dark brown, circular or irregularly shaped spots on the leaves (Fig. 1A and B), and sunken, circular or irregular necrotic spots on the fruits (Fig. 1C). The affected stems turned brown to dark brown (Fig. 1D), became gray, and later died.

A total of 82 isolates of *Colletotrichum* species were obtained from samples with symptoms of anthracnose. Out of the isolates, 75 were identified as *Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc., and the others as *C. acutatum* J.H. Simmonds based on their morphological and cultural characteristics. Twenty six of *C. gloeosporioides* isolates produced their teleomorph *Glomerella cingulata* (Stoneman) Spauld. & H. Schrenk in potato dextrose agar (PDA) culture. The morphological characteristics of *C. gloeosporioides* (teleomorph: *G. cingulata*) and *C. acutatum* examined by the authors were similar to those described by Sutton (1992). The isolation frequency shows that *C. gloeosporioides* is the predominant fungus responsible for anthracnose of highbush blueberries in Korea (Table 1). *C. gloeosporioides* was isolated from leaves, fruits and stems of highbush blueberries, but *C. acutatum* only from leaves and fruits.

Table 1. Isolation of *Colletotrichum* spp. from diseased plant parts of highbush blueberry trees

Colletotrichum spp.	No. of isolates obtained			
	Leaf	Fruit	Stem	Total
C. gloeosporioides	28	42	5	75
C. acutatum	1	6	0	7

Colonies of *C. gloeosporioides* on PDA were gray to dark gray and showed aerial mycelium in tufts (Fig. 2A). Conidia of the fungus were unicellular, hyaline, straight, cylindrical, round at ends or slightly narrow at one end

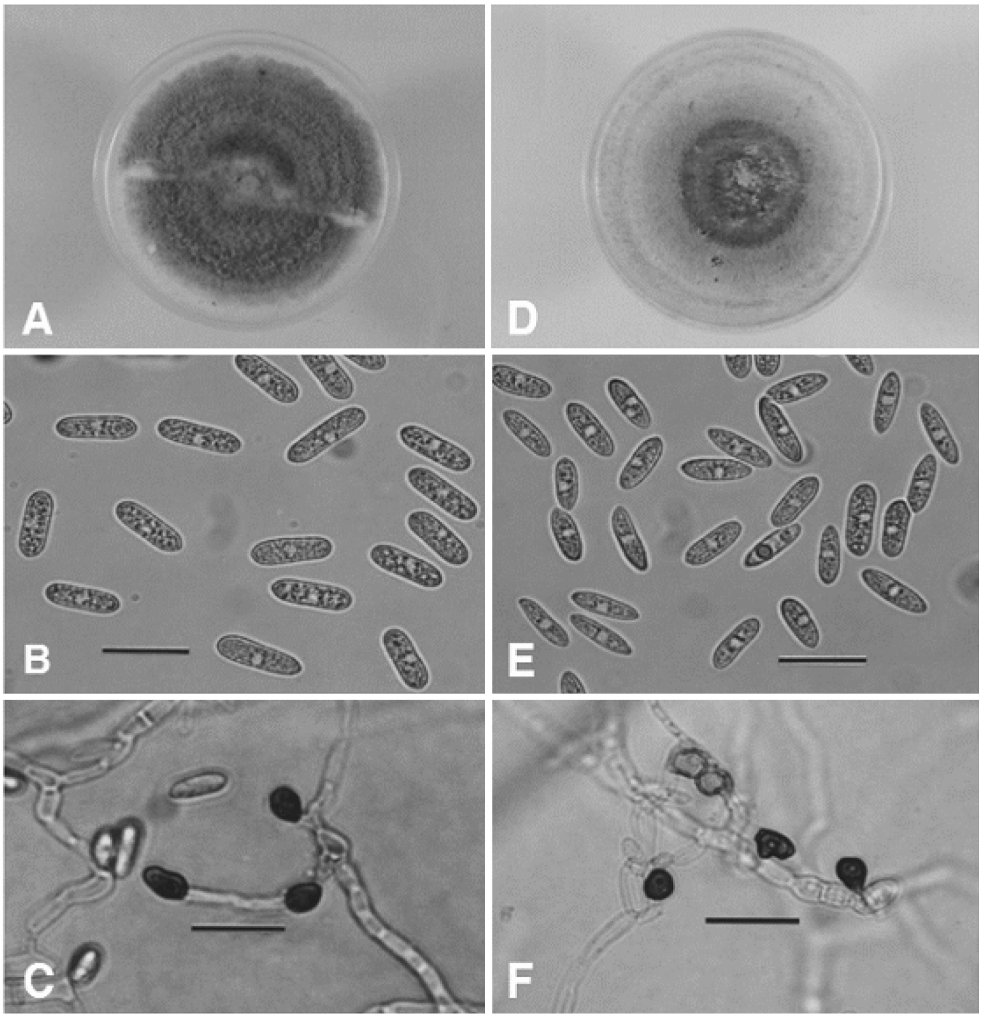

Fig. 2. Morphological features of *Colletotrichum gloeosporioides* (A~C) and *C. acutatum* (D~E) isolated from highbush blueberry trees. A and D, 20-day-old colonies grown on PDA at 24°C; B and E, conidia; C and F, appressoria. Each scale bar represents 20 μm.

Table 2. Pathogenicity of *Colletotrichum gloeosporioides* and *C. acutatum* isolates on leaves of highbush blueberry cultivars by artificial inoculation

Colletotrichum species	Isolate	Pathogenicity[a] of tested isolates on leaves of highbush blueberry cultivars					
		Wounded			Unwounded		
		Duke	Darrow	Coville	Duke	Darrow	Coville
C. gloeosporioides	C08-13	++	++	+	+	+	–
	C08-50	++	+	+	+	–	–
	C08-60	+	+	+	+	–	–
C. acutatum	C08-01	++	+	+	+	–	–
	C08-06	++	++	++	+	+	–
	C08-62	++	+	+	+	–	–
Control		–	–	–	–	–	–

[a]Pathogenicity was rated based on the lesion formation seven days after inoculation. ++, above 8 mm of lesion diameter; +, 2~7 mm of lesion diameter; –, no symptom.

(Fig. 2B), and measured 14.0~21.5 × 4.0~6.5 μm. Appressoria were brown to dark brown, ovate, obovate, clavate, sometimes lobed (Fig. 2C), and measured 7.0~17.5 × 5.0~12.5 μm. Perithecia of the fungal teleomorph produced in PDA culture were subglobose. Asci were clavate to cylindrical, 8-spored and measured 52.5~102.5 × 7.5~12.5 μm. Ascospores were unicellular, hyaline, slightly curved fusiform or ellipsoid, and measured 12.5~25.0 × 3.5~5.5 μm.

Colonies of *C. acutatum* on PDA were reddish gray to dark gray and showed orange conidial masses scattered on the surface of cultures (Fig. 2D). Conidia of the fungus were unicellular, hyaline, straight, fusiform, abruptly tapered at each end (Fig. 2E), and measured 10.0~20.0 × 3.5~5.0 μm. Appressoria were pale to dark brown, ovate to clavate, slightly irregular or lobed (Fig. 2F), and measured 5.0~15.0 × 4.5~7.5 μm.

Three isolates of each *C. gloeosporioides* and *C. acutatum* were tested for their pathogenicity to leaves of highbush blueberry by artificial inoculation with spore suspensions (2~3 × 10^6 conidia/*ml*) prepared from 20-day-old PDA cultures. Inoculation was made by dropping 20 μl of each spore suspension on leaves of the highbush blueberry cultivars Duke, Darrow, and Coville unwounded or wounded by pinprick. The same quantity of sterile distilled water was used as the control. The inoculated leaves were placed in humid plastic boxes (30 × 24 × 6 cm) at 25°C. Pathogenicity of the isolates was rated based on the lesion formation seven days after inoculation. The inoculation test was performed with three replicates.

All the tested isolates of *C. gloeosporioides* and *C. acutatum* induced anthracnose symptoms on the leaves of highbush blueberry cultivars tested by artificial inoculation (Table 2), which were similar to what was observed in the orchards. The isolates readily induced the symptoms on the leaves of all the cultivars by wound inoculation, but weakly or not at all by unwounded inoculation, suggesting that wounding may promote anthracnose lesion development on the leaves of highbush blueberry trees in the orchards. The inoculation tests showed that the cultivar Duke is more susceptible to the *Colletotrichum* species than the cultivars Darrow and Coville. There was no difference in pathogenicity between *C. gloeosporioides* and *C. acutatum* isolates tested. The two *Colletotrichum* species which induced symptoms on the leaves were re-isolated from the symptoms.

C. gloeosporioides (teleomorph: *G. cingulata*) has been reported as causing fruit rot or anthracnose fruit rot in highbush blueberries (Farr *et al*., 1989; Milholland, 1995). It was also reported that *C. acutatum* was identified as a causal agent of ripe rot of blueberry fruits (Milholland, 1995), with Barrau *et al*. (2001) reporting that *C. acutatum* caused anthracnose on leaves of the highbush blueberry. In the present study, it was revealed that both *C. gloeosporioides* and *C. acutatum* cause anthracnose of the highbush blueberry in Korea. Previously in Korea, only *C. gloeosporioides* has been reported as the causal fungus of anthracnose of blueberry (Kwon *et al*., 2008). This is the first report that *C. acutatum* causes anthracnose in the highbush blueberry in Korea.

References

Barrau, C., de los Santos, B. and Romero, F. 2001. First report of *Colletotrichum acutatum* in blueberry plants in Spain. *Plant Dis.* 85:1285.

Farr, D. F., Bills, G. F., Chamuris, G. P. and Rossman, A. Y. 1989. Fungi on Plants and Plant Products in the United States. APS Press. The American Phytopathological Society, St. Paul, Minnesota, USA.

Kwon, J. H., Cheon, M. G. and Park, C. S. 2008. Anthracnose of blueberry (*Vaccinum* spp.) of caused by *Colletotrichum gloeosporioides* in Korea. *Res. Plant Dis.* 14:61-63.

Milholland, R. D. 1995. Anthracnose fruit rot (ripe rot). In: Compendium of Blueberry and Cranberry Diseases, p. 17. Eds. F. L. Caruso and D. C. Ramsdell. APS Press, The American Phytopathological Society, St. Paul, MN, USA.

Sutton, B. C. 1992. The genus *Glomerella* and its anamorph *Colletotrichum.* In: *Colletotrichum:* Biology, Pathology and Control, pp. 1-26. Eds. J. A. Bailey and M. J. Jeger. CAB International, Wallingford, Oxon, UK.