Occurrence of Anthracnose on Welsh Onion Caused by *Colletotrichum circinans*

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Anthracnose occurred frequently on leaf sheaths of Welsh onions grown in Gangwha island, Korea in November, 2007. The disease incidence was as high as 30% in five fields investigated. A total of 20 single spore isolates of *Colletotrichum* species were obtained from the affected plants, and all the isolates were identified as *Colletotrichum circinans* based on their morphological and cultural characteristics. Three isolates of the fungus caused anthracnose symptoms on the leaf sheaths of Welsh onions by artificial inoculation, which were similar to those observed during the field survey. In this study, the mycological and pathological characteristics of *C. circinans* identified as causing anthracnose of Welsh onions are clarified.

KEYWORDS : Anthracnose, *Colletotrichum circinans*, Pathogenicity, Welsh onion

Welsh onion (*Allium fistulosum* L.) is widely grown in the temperate and subtropical regions of the world. The plant is cultivated commonly in Korea and it is an important vegetable for cooking. Anthracnose symptoms were observed frequently on leaf sheaths of Welsh onions grown in Gangwha island, Korea, during a disease survey performed in November, 2007. The symptoms appeared as irregular black spots on the leaf sheaths, and the infected leaf sheaths were blighted (Fig. 1A and 1B). Grayish conidial masses were produced sometimes on the black spots. Eight fields of Welsh onion were investigated for the disease occurrence. The incidence of the disease reached as high as 30% in five fields investigated. The disease did not occur in the other fields investigated.

A total of 20 single spore isolates of *Colletotrichum* species were obtained from anthracnose symptomatic leaf sheaths of the Welsh onions. Morphological and cultural characteristics of the isolates were examined for identification purposes. All the isolates were identified as *Colletotrichum circinans* (Berk.) Voglino. The morphological characteristics of *C. circinans* we examined were similar to those described by Sutton (1992) (Table 1).

Colonies of *C. circinans* grown on potato dextrose agar (PDA) had dark brown with grayish aerial mycelia. Globose to pulvinate or irregular sclerotia and setae were produced abundantly on the surface of colonies (Fig. 2A). Setae produced on lesions were dark brown to black, 1~5 septate and measured 32.5~177.5 × 3.0~7.0 (Fig. 2B). Conidia were falcate, fusiform, gradually tapered to each end and measured 16.5~27.5 × 3.0~4.5 μm (Fig. 2C). Appressoria were brown to dark brown, globose to clavate, lobed to irregular and measured 6.5~15.0 × 5.0~7.5 μm

Fig. 1. Anthracnose symptoms on Welsh onion plants observed in the field. A and B, irregular black spots on the blighted leaf sheaths.

(Fig. 2D). The temperature range and optimum temperature for mycelial growth of the fungus on PDA were 10~35°C and 26~28°C, respectively.

Three isolates of *C. circinans* were tested for pathogenicity to leaf sheaths and leaves of Welsh onion (cultivar Seokchangoedaepa) by artificial inoculation with conidial suspensions ($1\sim2 \times 10^6$ conidia/ml) which were prepared from 20-day-old PDA cultures. Inoculations were performed by dropping 20 μl of conidial suspensions onto each segment (25 cm in length) of leaf sheaths and leaves of 5-month-old Welsh onion in the humid plastic boxes (39 × 32 × 14 cm). The same quantity of sterile distilled water was used as the control. The plastic boxes were placed in an incubator at 26°C for five days. Disease ratings were made based on the degree of anthracnose symptoms induced on the leaf sheaths and leaves five days

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Table 1. Morphological characteristics of *Colletotrichum circinans* isolated from leaf sheaths of Welsh onion

Structure		Characteristics	
		Present isolates	Sutton (1992)
Conidium	Shape	Falcate, fusiform, gradually tapered to each end	Falcate, fusiform, gradually tapered to each end
	Size (μm)	16.5~27.5 $\times$ 3.0~4.5	19.0~21.0 $\times$ 3.5
Appressorium	Shape	Brown to dark brown, globose to clavate, lobed to irregular	Clavate to irregular, margin entire
	Size (μm)	6.5~15.0 $\times$ 5.0~7.5	10.0~14.5 $\times$ 6.0~6.5

Fig. 2. Morphological and cultural features of *Colletotrichum circinans* isolated from leaf sheaths of Welsh onion. A, a 20-day-old colony grown on PDA at 24°C; B, setae on the lesions (scale bar = 40 μm); C, conidia (scale bar = 20 μm); D, appressoria (scale bar = 20 μm).

after inoculation. The inoculation test was performed in three independent replicates.

All of the tested isolates of *C. circinans* induced anthracnose symptoms on the leaf sheaths following artificial inoculation but not on the leaves (Table 2). The symptoms were similar to those observed during the field survey. The fungal species was re-isolated from the affected areas.

C. circinans was previously recorded as *Colletotrichum dematium* (Pers.) Grove f. *circinans* (Berk.) Arx, which is specific to *Alliums* spp. (Arx, 1957; Arx, 1970; Arx, 1981). However, Sutton (1992) described *C. circinans* as a distinct species from *C. dematium*. It has been reported that the fungus causes smudge or leaf spot of

Table 2. Pathogenicity of *Colletotrichum circinans* isolates on Welsh onion plants by artificial inoculation

Isolate	Virulence of isolates on host plants ^a	
	Leaf sheath	Leaf
C07-39	+	–
C07-45	+	–
C07-53	+	–
Control	–	–

^aDisease severity was rated five days after inoculation. +, anthracnose lesions produced; –, no symptom.

Allium spp. (Farr *et al.*, 1989). The fungus is also recorded as an anthracnose pathogen of onion and Welsh

onion in Korea (Cho and Shin, 2004). However, there has been no detailed report on mycological and pathological characteristics of *C. circinans* causing anthracnose of the plants. In this study, mycological and pathological characteristics of *C. circinans* causing anthracnose of Welsh onion were clarified.

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