

Occurrence of Anthracnose on Indian Fig Cactus Caused by *Glomerella cingulata* and *Colletotrichum gloeosporioides*

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Anthracnose symptoms were frequently found on stems of Indian fig cactus in Cheju island of Korea in 1998 and 1999. Typical symptoms were gray to black dry rot of stems with concentric arrays of dot-like spots. A *Glomerella* sp. or a *Colletotrichum* sp. was frequently isolated from the symptoms, both of which were identified as *Glomerella cingulata* and its anamorph, *Colletotrichum gloeosporioides* based on their morphological and cultural characteristics. Out of 31 isolates obtained from the symptoms, 12 isolates were the anamorph producing only conidia, four isolates the teleomorph producing only ascospores, and 15 isolates the holomorph producing both spores on potato dextrose agar. Stem rots similar to the original anthracnose symptoms were induced by wound inoculation of conidia and ascospores but not by non-wound inoculation. The anamorphic isolates caused more extensive stem rot than the teleomorphic and holomorphic ones.

Keywords : anthracnose, *Colletotrichum gloeosporioides*, *Glomerella cingulata*, Indian fig cactus, pathogenicity.

A cactus species, Indian fig cactus [*Opuntia ficus-indica* (L.) Mill.] has been extensively cultivated for health food or processed foodstuff in Cheju island of Korea. Stem rot severely occurred up to 40% on cacti in five of 22 fields surveyed during the growing seasons in 1998 and 1999. Symptoms mostly developed on wounded or old lower parts of the cactus stems (Fig. 1, A-C). Numerous acervuli appeared as concentric small black dots at the later stage of the infection. Severely infected stem nodes dried and thoroughly rotted. A preliminary study on cactus anthracnose was previously reported by the authors (Kim et al., 2000).

A total of 31 single spore isolates of *Glomerella* and *Colletotrichum* spp. were obtained from the lesions on cactus stems. All the isolates were identified as *Glomerella cingulata* (Stonem.) Spauld. & von Schrenk based on the morphological and cultural characteristics. Twelve isolates

produced only conidia of the anamorph, *Colletotrichum gloeosporioides* (Penz.) Penz. and Sacc. on potato dextrose agar (PDA). Four isolates produced only ascospores on the medium, and 15 isolates both conidia and ascospores. The teleomorphic isolates produced abundant ascospores on the medium and host tissues but no conidia. The anamorphic isolates produced abundant conidia in the medium and host tissues, and the holomorphic isolates conidia and ascospores. Setae were rarely produced only by the anamorphic isolates, which were dark brown to black, 1-4 septate and measured 42-150 × 4-5 µm.

The morphological and cultural features of *G. cingulata* and its anamorph, *C. gloeosporioides* are shown in Fig. 2. Colonies of the anamorphic isolate were grayish black (Fig. 2, A), and those of the teleomorphic isolate whitish gray to dark gray (Fig. 2, D). Conidiomata and ascomata were produced on PDA by the anamorphic and teleomorphic isolates, respectively. Conidia were unicellular, hyaline, straight, cylindrical, round at ends or slightly narrow at one end (Fig. 2, B) and measured 10-20 × 4-6 µm. Appressoria were dark brown to black, clavate, ovate, lobed or irregular (Fig. 2, C) and measured 7-16 × 6-12 µm. Asci are clavate to cylindrical, 8-spored (Fig. 2, E) and measured 58-90 × 8-12 µm. Ascospores are unicellular, hyaline, slightly curved fusiform or ellipsoid (Fig. 2, F) and measured 12-22 × 4-6 µm. These morphological and cultural characteristics of *G. cingulata* and *C. gloeosporioides* were consistent with the classification of previous workers (Arx, 1970; Arx, 1981; Mordue, 1971; Sutton, 1980).

Six isolates of the fungus were used for pathogenicity tests to 30 to 40-day-old cactus stems by wound or non-wound inoculation using spore suspensions (2-3 × 10⁶ spores/ml). The isolates induced stem rots similar to the original anthracnose symptoms on cactus stems by wound inoculation of conidia and ascospores but not by non-wound inoculation (Table 1), suggesting that the disease occurrence in the field is closely associated with wounds on cactus stems. It is known that strong wind blows very often in Cheju island. Accordingly, it is considered that severe outbreaks of cactus anthracnose in Cheju island are due to wounds on cacti caused by frequent and strong wind. The

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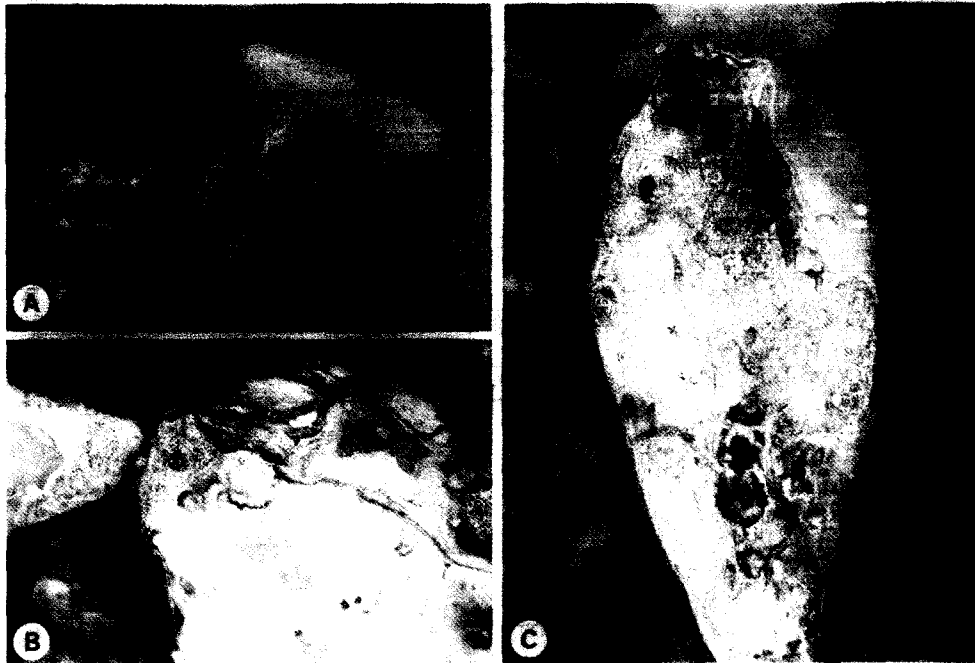


Fig. 1. Stem rot symptoms of Indian fig cactus in fields. A, lesions developed from the margin and the naturally wounded part of a stem; B and C, note concentric spots with dot-like acervuli on the old stems.

inoculation tests also reveal that the anamorph is more virulent to cactus stems than the teleomorph, which is similar to the pathological characteristics of the fungus causing anthracnose on red pepper fruits (Kim et al., 1986).

G. cingulata and its anamorph, *C. gloeosporioides* cause anthracnose on several hundred species of plants (Arx, 1970; Farr et al., 1989; Sutton, 1992). It is recorded that the fungus causes zonate leaf spot on a species (*Opuntia* sp.) of cactus (Farr et al., 1989). This is the first report that *G. cingulata* causes anthracnose of *Opuntia ficus-indica*. The result of artificial inoculation tests in the present study

showed that anthracnose lesions induced on the inoculated cactus stems were smaller than natural lesions observed in fields. Severe symptoms were mostly observed on old lower parts of cactus stems during the field survey, suggesting that severity of cactus anthracnose may be associated with age of cactus stems. Further study on occurrence of cactus anthracnose caused by the teleomorph of *G. cingulata* is needed.

Table 1. Pathogenicity of different types of *Glomerella cingulata* on stems of Indian fig cactus by artificial inoculation

Isolate No.	Type	Spores inoculated	Disease severity ^a	
			Non-wounded	Wounded
C99-101	Anamorph	Conidia	-	++
C99-103	Anamorph	Conidia	-	++
C99-105	Holomorph	Conidia and ascospores	-	+
C99-106	Holomorph	Conidia and ascospores	-	+
C99-107	Teleomorph	Ascospores	-	+
C99-115	Teleomorph	Ascospores	-	+
Control			-	-

^aDisease severity was rated 30 days after inoculation: ++, 5-10 mm of lesion length; +, 3-5 mm of lesion length; -, no symptom.

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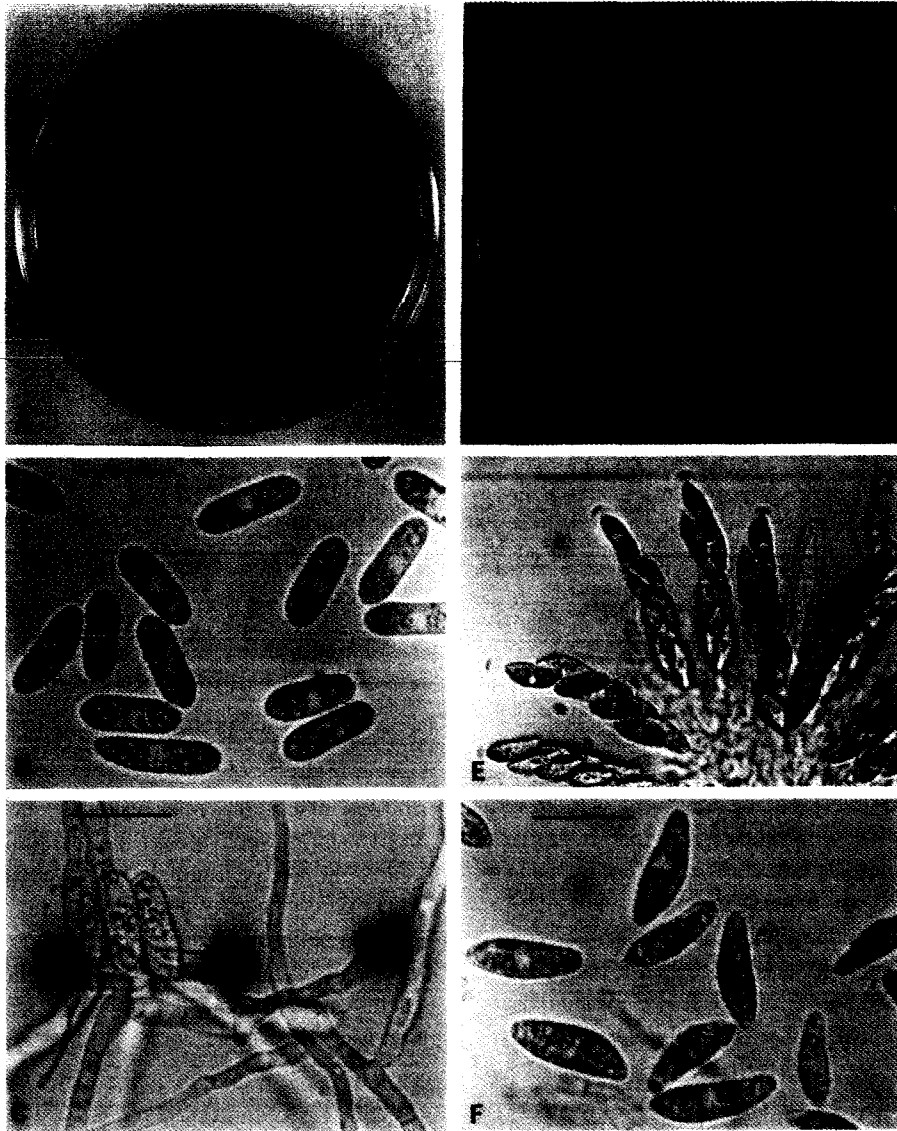


Fig. 2. Cultural and morphological features of *Glomerella cingulata* and its anamorph, *Colletotrichum gloeosporioides*, isolated from cactus stems. A and D, colonies of the anamorph and teleomorph, respectively, on PDA after 20 days of incubation at 26°C under alternating cycles of 12hr NUV light and 12hr darkness; B, conidia (scale bar=15 µm); C, appressoria developed from conidia (scale bar=15 µm); E, asci including ascospores (scale bar=30 µm); F, ascospores (scale bar=15 µm).

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