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Occurrence of Gray Mold in Freesia and Gladiolus Caused by *Botrytis gladiolorum* in Korea

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Gray mold severely occurred up to 50% in freesia and gladiolus grown in the fields and greenhouses in Korea from 1998 to 2000. Symptoms appeared as spot and blight on leaves and flowers of infected plants. A total of 25 isolates was obtained from infected plant parts. All the isolates were identified as *Botrytis gladiolorum* based on their morphological and cultural characteristics. Gray mold symptoms similar to those observed in the fields and greenhouses were induced on the plants of freesia and gladiolus by artificial inoculation with four isolates of the fungus. This is the first report of gray mold of freesia caused by *B. gladiolorum* in Korea.

Keywords **:** *Botrytis gladiolorum*, freesia, gladiolus, gray mold.

Freesia and gladiolus have been cultivated extensively as popular cut flowers worldwide. Severe outbreaks of gray mold symptoms on the plants were frequently observed in major cultivating areas in Korea during a disease survey of the plants from 1998 to 2000. The disease incidence in the two plants reached up to 50% in some severely damaged fields and greenhouses (Table 1).

Symptoms developed on leaves, leaf sheaths, and flowers (Fig. 1A-D). Lesions on the leaves started with small whitish spots in the early stage, which gradually turned reddish brown. They rapidly enlarged and turned water-soaked, irregular, and reddish brown in cool and humid conditions. The severely infected leaves dried and rolled from the tips. Occasionally, the lesions remained as small and reddish brown spots in hot and dry conditions. Lesions on leaf sheaths appeared as water-soaked, irregular, whitish gray, or reddish brown spots and blight with grayish conidial masses. As the disease progressed, infected leaf sheaths bent toward the lesions and blighted completely later. Lesions on stems and flowers appeared as small spots with reddish brown borders. Symptoms of the disease on leaves of gladiolus were similar to that found in freesia (Fig. 1E and F).

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Table 1. Occurrence of gray mold in major cultivating areas of freesia and gladiolus from 1998 to 2000

Plant	Location	No. of fields surveyed	Disease incidence (%)	
			Average	Range
Freesia	Imsil	8	12	0-50
	Jeongeup	3	<1	0-1
	Icheon	4	10	0-40
Gladiolus	Asan	5	3	0-5
	Busan	3	1.5	0-3

A total of 25 monoconidial isolates was obtained from the lesions on freesia and gladiolus. All the isolates were identified as *Botrytis gladiolorum* Timmerm. based on their morphological and cultural characteristics (Fig. 2 and Table 2). Conidiophores were erect, 0.4-1.4 mm high. Stipes were long, slender, cylindrical, brown below, paler near the top, 15.0-20.0 μm wide, some with swollen basal cell, and branched one to two times alternating at about two-thirds of the height from the basal portion (Fig. 2A). Conidiogenous cells were inflated at apices producing conidia on sterigma (Fig. 2B). Conidia were ellipsoidal or obovoid, unicellular, very rarely one-septate, pale brown, smooth, and measured 13.8-22.5 × 8.0-12.5 μm (usually 14.4-16.3 × 10.0-12.0 μm) in diameter (Fig. 2C). Colony of the isolates on PDA at 21°C consisted of pale gray, abundant aerial mycelium in the darkness, and produced small, black, round or irregular, numerous sclerotia by illumination of near ultraviolet (NUV) light (Fig. 2D and E). The morphological and cultural characteristics of the isolates were consistent with those described in previous works (Arx, 1987; Ellis, 1971; Gould, 1954; Kishi, 1998; Wang et al., 1996).

To prove the pathogenicity of the fungus to the host plants, four isolates of the fungus, B99115, B99117, B0008-1, and B0008-2, were used. Mycelial plugs of each isolate were transferred to PDA in plastic petri dishes. The cultures

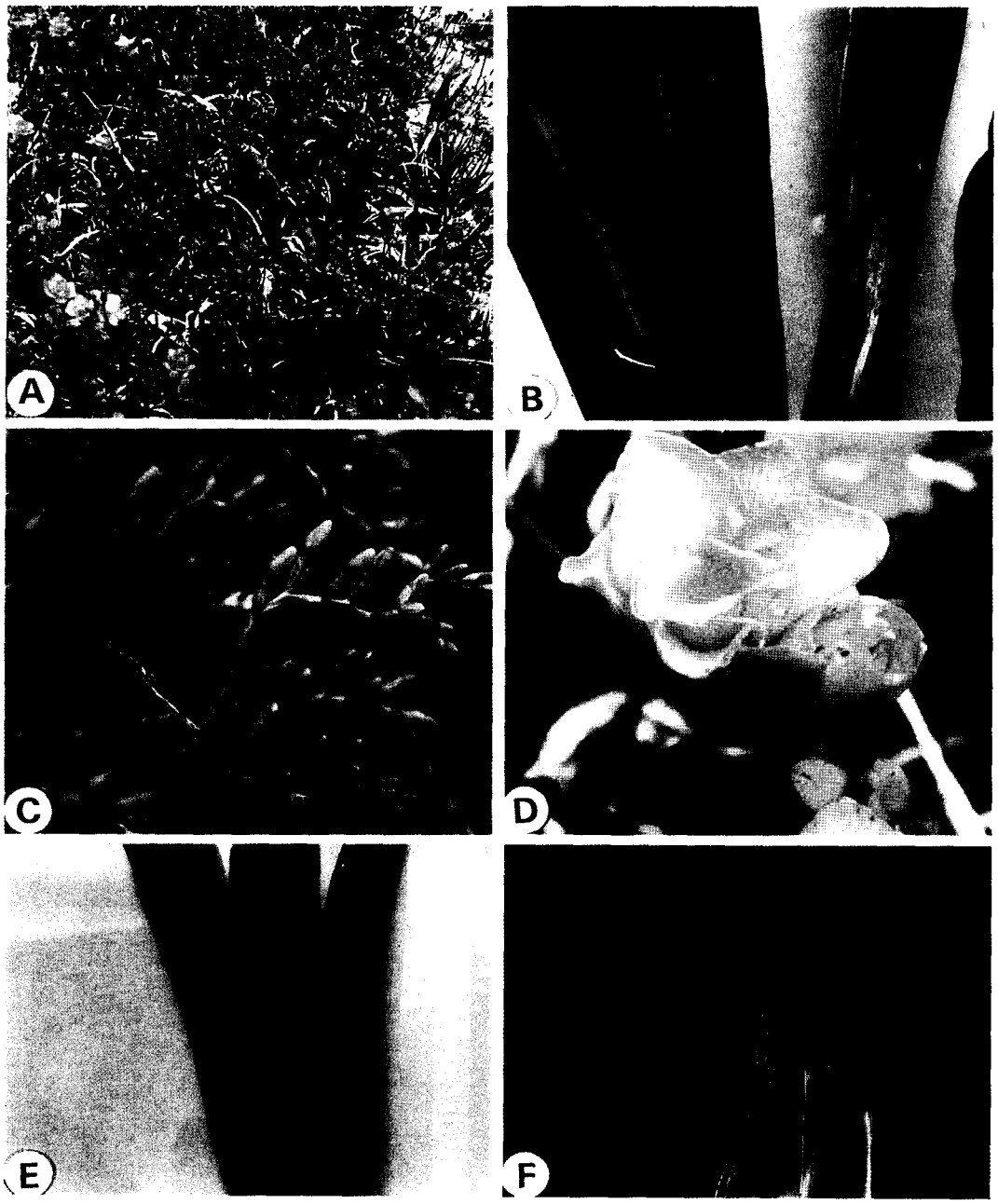

Fig. 1. Symptoms of gray mold in freesia (**A-D**) and gladiolus (**E** and **F**). (**A**) infected plants in the field; (**B**) lesion on a leaf sheath; (**C**) spots on stems; (**D**) spots on flower; (**E** and **F**) lesions on leaves of gladiolus.

were incubated at 21°C in the dark for 5 days and then illuminated by NUV light (12 hours/day) for 5 days. Conidial suspension was made by flooding the cultures with sterilized distilled water. The conidial suspension (3-5 x 10^6/ml) of each isolate was sprayed onto leaves of 20-day-old plants of freesia and gladiolus. Inoculated plants were placed in a dew chamber at 21°C for 48 hours for the disease development and then moved into a greenhouse. Control plants were sprayed with sterilized distilled water. All the inoculated isolates induced gray mold symptoms on the plants of freesia and gladiolus but no symptoms on the control plants. Symptoms first appeared as small spots on the leaves of the plant within a few days after inoculation. The spots gradually enlarged and resulted in large blight lesions. The fungus was re-isolated from the lesions on the plants inoculated.

It has been recorded that *B. gladiolorum* causes gray mold on Iridaceae, i.e. gladiolus, freesia, ixia, crocus, and

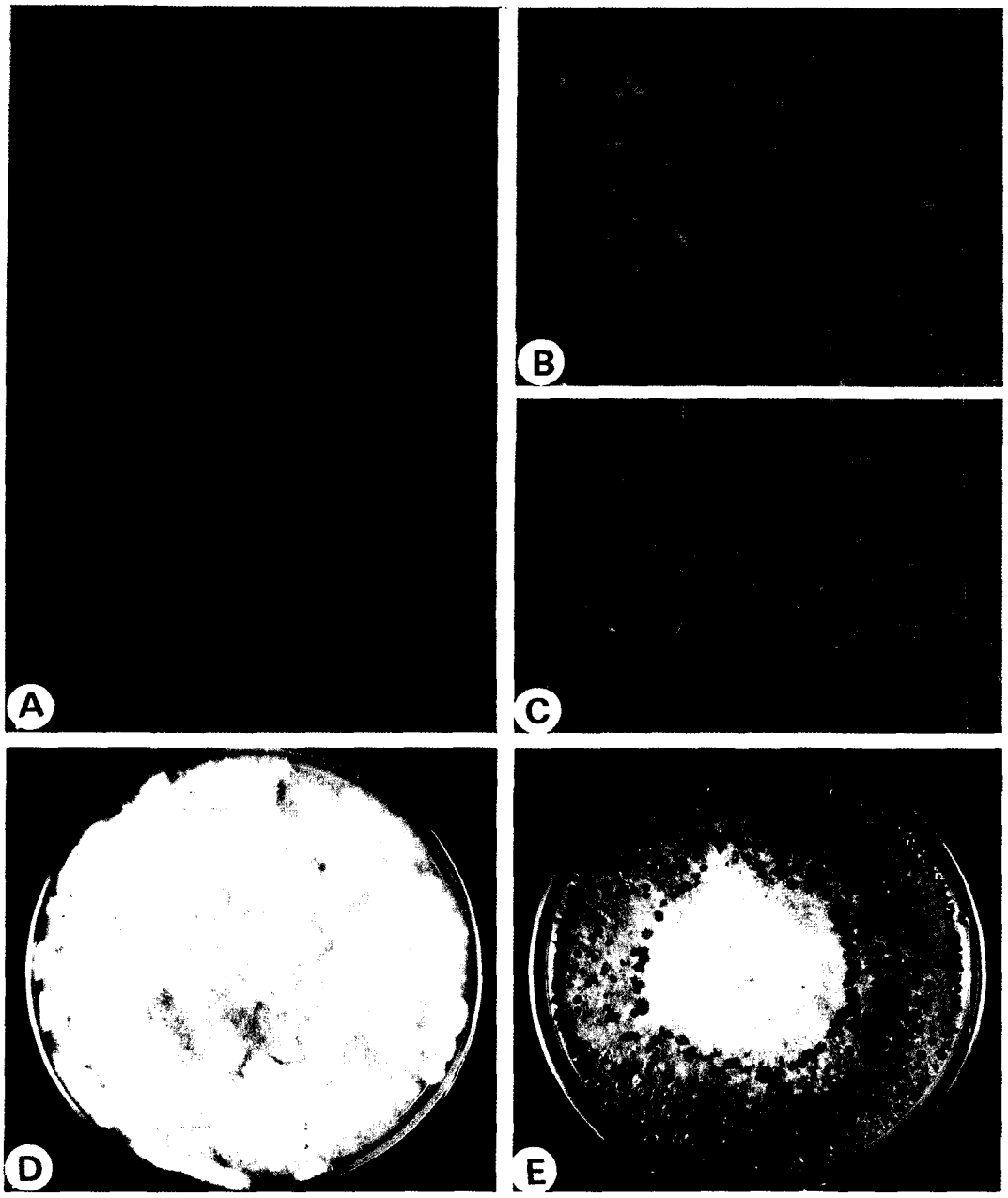

Fig. 2. Morphological and cultural features of *Botrytis gladiolorum*. (**A** and **B**) a conidiophore bearing conidia (scale bar in A = 40 μm, B = 10 μm); (**C**) conidia (scale bar = 10 μm); (**D** and **E**) a colony and sclerotia on PDA.

iris in North America, Europe, Africa, New Zealand, China, and Japan (Boerema and Hamers, 1989; Gould, 1954; Kishi, 1998; Mckenzie, 1990; Plate and Schneider, 1972; Wang et al., 1996). The conidial size of the fungus is very similar to that of *Botrytis croci* occurring in crocus, but is distinguished by the production of sclerotia (Boerema and Hamers, 1989). In Korea, gray mold caused by the fungus was first found in imported gladiolus grown in the field for quarantine (Cho et al., 1990). *Botrytis cinerea* Pers.: Fr. was also recorded as a causal fungus of the disease in gladiolus (Anonymous, 1998). This is the first record of gray mold of freesia caused by *B. gladiolorum* in Korea.

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Table 2. Morphological characteristics of *Botrytis gladiolorum* isolated from lesions of freesia and gladiolus

Structure examined	Present isolate	*Botrytis gladiolorum*		
		Ellis (1971)	Kishi (1998)	Wang et al. (1996)
Conidiophores				
Color	Brown - pale brown	–[a]	–	Pale brown
Length (mm)	0.4-1.4	–	–	0.6-3.2
Width (μm)	15.0-20.0	–	–	7-15
Conidia				
Color	Pale brown	–	Hyaline - pale brown	Pale brown
Shape	Ellipsoidal - obovoid	–	Ellipsoidal - obovoid	Ellipsoidal - obovoid
Surface	Smooth	–	Smooth	Smooth
Size (μm)	13.8-22.5 × 8.0-12.5	10-22 × 8-13	9.0-19.4 × 7.2-14.0	8.9-23 × 7.7-15.3
Sclerotia				
Color	Black	–	Black	Black
Shape	Spherical or irregular	–	Ellipsoidal	Spherical or irregular
Size (mm)	0.4-2.2 × 0.6-2.9	–	1-3	1-5

[a] – = not described.

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