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Occurrence of Gray Mold in Castor Bean Caused by *Botrytis cinerea* and *Amphobotrys ricini* in Korea

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Gray mold was observed on leaves of castor bean grown in Wonju and Okcheon in Korea in October 2000. Symptoms developed in the form of spot and blight with sporulation of the causal fungi at the marginal or central parts of the leaves. A total of 25 isolates were obtained from the infected leaves of castor bean. Out of the 25 isolates, 5 isolates which originated from Wonju were identified as *Botrytis cinerea*, while 20 isolates from Okcheon were identified as *Amphobotrys ricini* based on morphological and cultural characteristics. Two isolates each of *B. cinerea* and *A. ricini* were tested for their pathogenicity to castor bean plants. Gray mold symptoms similar to those observed in the fields were induced on leaves of castor bean by artificial inoculation. This is the first report of gray mold in castor bean caused by *B. cinerea* and *A. ricini* in Korea.

Keywords **:** *Amphobotrys ricini*, *Botrytis cinerea*, castor bean, gray mold.

Castor bean (*Ricinus communis* L.), which is a native plant of Ethiopia and North Africa, is cultivated as an oil or medicinal plant in tropical Asia and the Indian continent. In Korea, the plant is cultivated as a culinary vegetable or medicinal plant. During a survey of Botrytis diseases on crops, gray mold was observed on leaves of castor bean in Wonju and Okcheon in Korea in October 2000. Gray mold symptoms on leaves of castor bean observed in Wonju area appeared as oval to irregular grayish spots. Lesions enlarged and became grayish brown blight with abundant conidial mass in humid conditions favorable for the disease development (Fig. 1). A total of five isolates were obtained from the lesions. Colonies of the isolates on potato dextrose agar (PDA) at 21°C consisted of pale gray, abundant aerial mycelium, and produced black, irregular and large sclerotia. Conidia examined by a light microscope were globose to subglobose or ellipsoidal, unicellular, pale brown, smooth, and measured 7.5-13.3×7.0-10.5 μm. By scanning through an electronic microscope, conidia were found to have warty surface. Conidiophores were erect and usually over 1.0 mm high. Stipes were slender, cylindrical, pale brown below, paler near the apics, 12.0-23.0 μm wide, some with swollen basal cell, and branches alternating at about three-fourths of the height from the basal portion and branched again two to three times. Conidiogenous cells were inflated at apices producing conidia on sterigma (Fig. 2). The morphological and cultural characteristics of the five fungal isolates fitted well with *Botrytis cinerea* Pers.: Fr. described by Ellis (1971).

Another gray mold of castor bean observed in Okcheon slightly differed from that found in Wonju in terms of spotted lesions on the leaves. The symptoms were circular to oval spots on the leaves at the early stage of infection. As symptoms progressed, lesions enlarged and became pale brown blight with dark blue to purple borders at the margins of the leaves (Fig. 1). Conidial mass developed on the lesions at the late stage of the disease, which was very similar to that observed in Wonju. A total of 20 isolates were obtained from the diseased leaves. Colonies on PDA at 24°C consisted of effuse, pure white, somewhat cottony mycelium, and produced small, black and irregular sclerotia. Conidia were globose, unicellular, pale brown, smooth, and measured 5.0-10.8 μm (av. 8.1 μm) in diameter. Microconidia produced in PDA culture were globose, hyaline, and measured 2.0-2.7 μm in diameter. Conidiophores scattering over the infected plant parts were single, erect, and usually 1.2-1.3 mm high. Stipes were long, slender, cylindrical, pale brown, and 10.0-12.5 μm wide, with unswollen basal cells, branches bifurcating at about two-thirds height from the basal portion, and branched dichotomously again two to three times. Each apical cell of the branches and branchlets was delimited by a septum. Conidiogenous cells were ampulliform, some where inflated at the apices, 6.3-8.8 μm wide, and produced conidia on cylindrical sterigma measuring 2.0-2.5 μm in length. Based on the morphological and cultural characteristics, all the fungal isolates from

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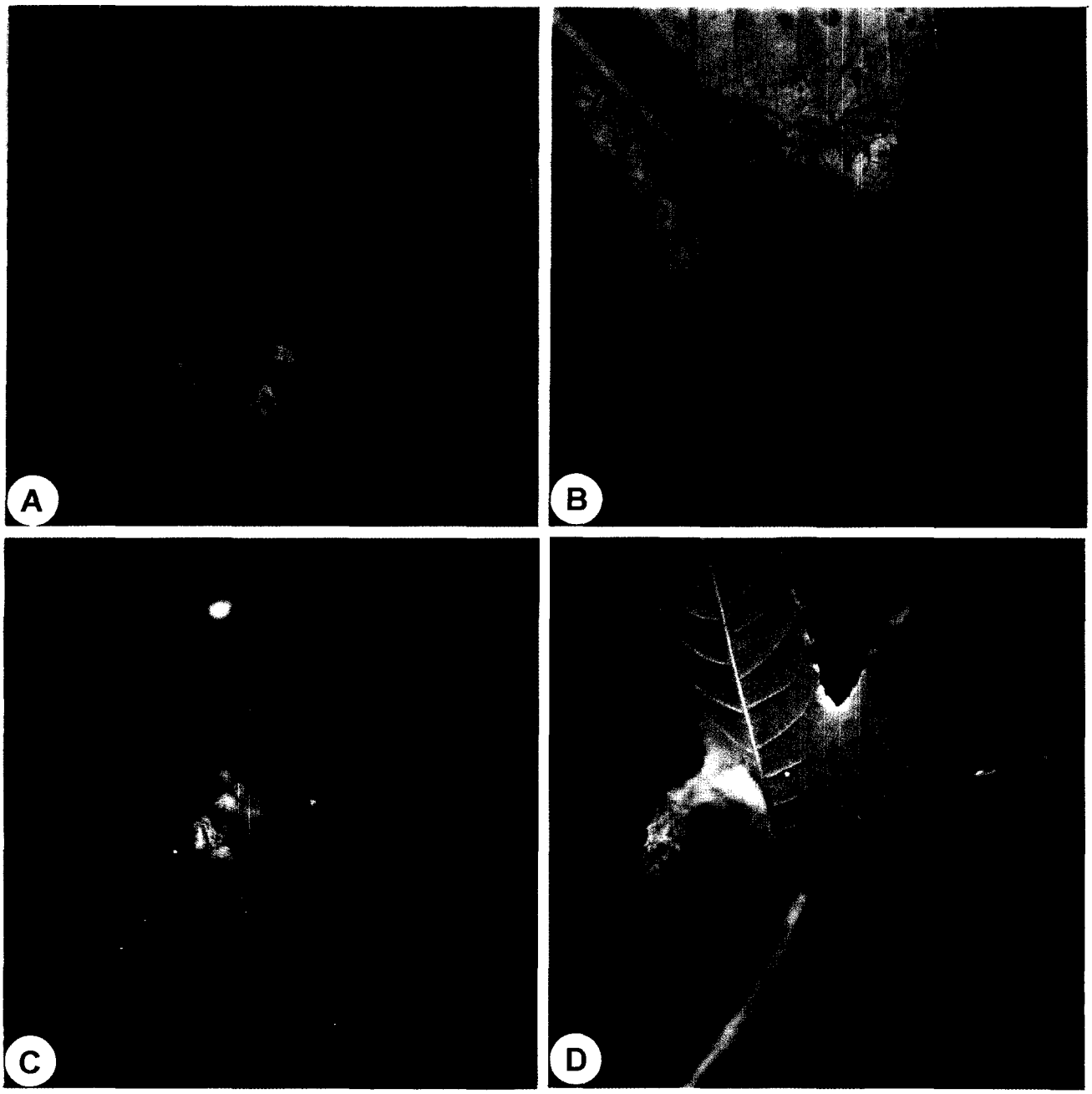

Fig. 1. Symptoms of gray mold on leaves of castor bean in the field. *Botrytis cinerea* was isolated from blighted lesions (**A** and **B**); *Amphobotrys ricini* was isolated from spotted lesions (**C** and **D**).

Okcheon were identified as *Amphobotrys ricini* (Buchwald) Hennebert (Table 1).

To prove the pathogenicity of the two fungi to the host plants, two isolates of each fungus were used. Mycelial plugs of each isolate were transferred to V-8 juice agar in plastic petri dishes. The cultures were incubated at 21°C in the dark for 3 days and then illuminated for 12 h near ultraviolet light (20w×3)/12 h dark for 5 days. Conidial suspensions were made by flooding the cultures with distilled water or 10% supernatant of V-8 juice. Conidial suspensions ($3\text{-}5\times10^6$/ml) of each isolate were sprayed onto 75-day-old castor bean plants. Inoculated plants were placed in a dew chamber at 24°C and 21°C for 48 h for the disease development and then moved into a greenhouse. Control plants were sprayed with distilled water. All the inoculated isolates of *B. cinerea* and *A. ricini* induced gray mold symptoms on leaves of castor bean. No symptoms were observed on the control plants. Symptoms first

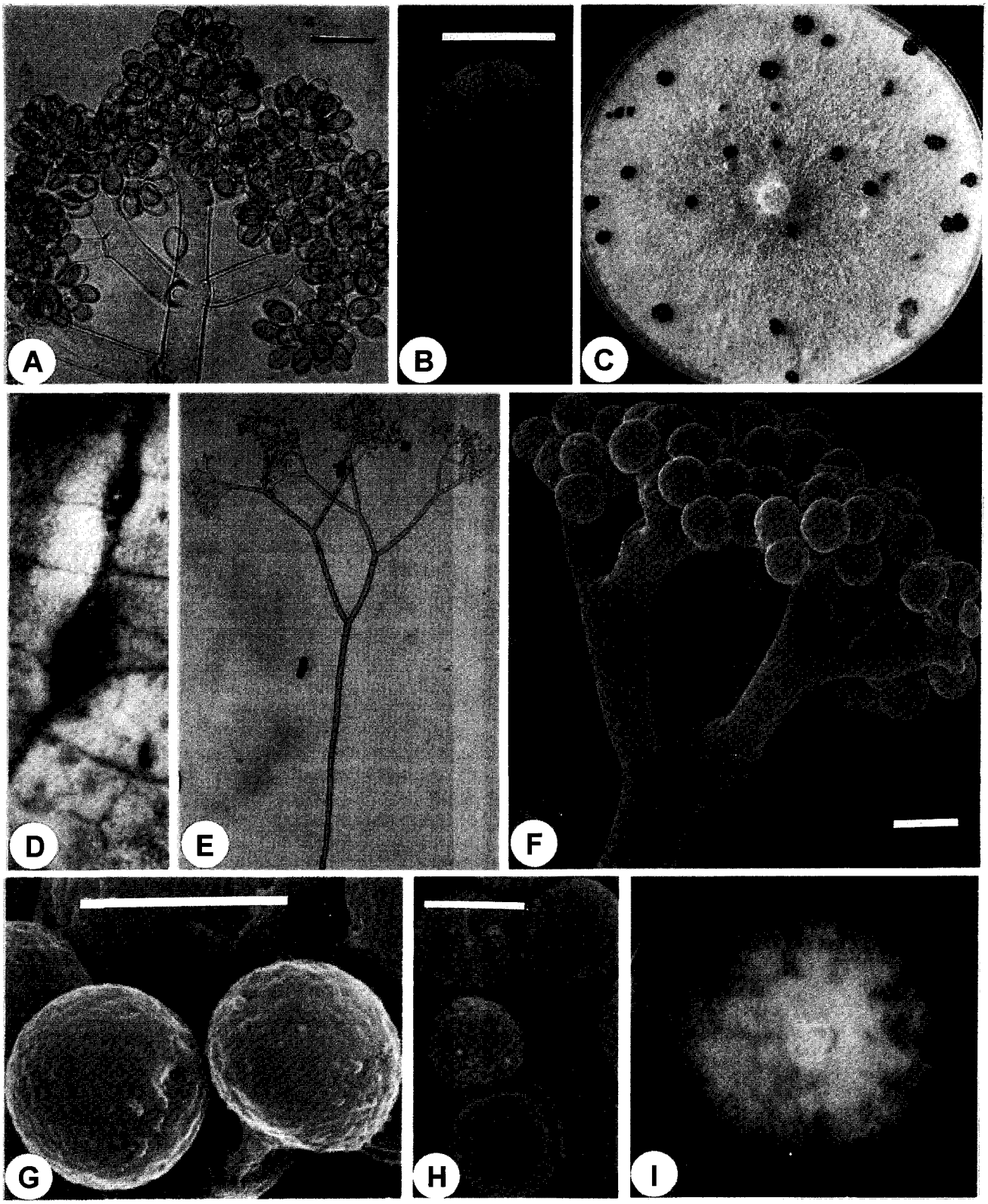

Fig. 2. Morphological and cultural features of *Botrytis cinerea* (**A-C**) and *Amphobotrys ricini* (**D-I**). (**A**) A conidiophore bearing conidia (scale bar=20 μm); (**B**) conidia observed by SEM (scale bar=5 μm); (**C**) a colony on PDA; (**D**) sclerotia produced on a diseased leaf; (**E** and **F**) a conidiophore bearing conidia (scale bar=10 μm); (**G** and **H**) conidia and microconidia observed by SEM. Each scale bar represents 8 μm and 2 μm, respectively; (**I**) a colony on PDA.

Table 1. Morphological characteristics of *Botrytis cinerea* and *Amphobotrys ricini* isolated from leaves of castor bean

Structure examined	Description of *B. cinerea*		Description of *A. ricini*	
	Present isolates	Ellis (1971)	Present isolates	Godfrey (1923)
Conidiophore				
Color	Pale brown	Pale brown	Pale brown	Pale brown
Length (mm)	>1	>1	1.2-1.3	–
Width (μm)	12.0-23.0	12.0-30.0	10.0-12.5	–
Conidium				
Color	Pale brown	Pale brown	Pale brown	Hyaline
Shape	Globose to subglobose or ellipsoidal	Ellipsoidal or obovoid	Globose	Globose
Surface (SEM)	Smooth (warty)	Smooth	Smooth	Smooth
Size (μm)	7.5-13.3×7.0-10.5	6-18×4-11	5.0-10.8	6-12
Sclerotia				
Color	Black	Black	Black	–
Shape	Irregular	–	Irregular or elongate	Irregular or elongate
Size (mm)	–	–	0.5-2.0×0.5-1.0	1-25

appeared as small spots on leaves of the plants within a few days after inoculation, and conidial mass developed on the lesions. The gray mold symptoms induced by the two fungi could not be distinguished from each other, but were similar to those observed in the fields. The two fungi were re-isolated from the lesions which developed on the inoculated leaves.

Botrytis and *Botrytis*-like fungi cause gray mold on a variety of plants (Ellis, 1971; Hennebert, 1973). However, occurrence of gray mold on castor bean caused by *B. cinerea* and *A. ricini* has not been reported in Korea. *B. cinerea* is a well-known fungus with an extremely wide range host (Ellis, 1971), and has also been reported pathogenic to castor bean in other countries (Alfieri et al., 1984; Tai, 1979).

Godfrey (1919; 1923) first reported gray mold of castor bean caused by *Sclerotinia ricini* Godfrey. Whetzel (1945) changed the fungal name as *Botryotinia ricini* (Godfrey) Whetzel. Hennebert (1973) named *Amphobotrys ricini* to accommodate the conidial state of *B. ricini*. The fungus also has been reported pathogenic to several plants including poinsettia (*Euphorbia pulcherrima*) in other countries (Barreto and Evans, 1998; Holocomb et al., 1989; Holocomb, 1990; Russo and Rossman, 1991; Sanoamuang, 1996; Whitney, 1986). In early 1900s, gray mold of castor bean caused by *A. ricini* heavily occurred in southern United States along with increased cultivation area (Godfrey, 1923). In Korea, castor bean is considered as a minor crop cultivated in small scale. Consequently, gray mold on the plant is not economically important, but the causal fungus could be a potential inoculum to other plants.

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