

Sooty Mold of Persimmon (*Diospyros kaki*) Caused by *Cladosporium cladosporioides*

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In 2002, sooty mold was observed on persimmon (*Diopyros kaki*) from the Jinju Agricultural Products Wholesale Market in Gyeongnam, Korea. The lesion of the sooty mold usually appeared as scars or wounds formed on the surface of the fruits. The symptom started with water soaking lesion, then the fruit softened rapidly. Colony of the causal pathogenic fungus was dark green in color on potato dextrose agar. The diameter of growing hyphae was 1-2 μm . The mostly one-celled conidia were ovoid, lemon or cylinder in shape, blastophores, and sized 46-132 μm . Erected conidiophores were long-branched chains and their lengths varied from 24 to 346 μm with 2-5 μm width. The optimum temperature for mycelial growth was about 20°C. Based on their mycological characteristics, the fungus was identified as *Cladosporium cladosporioides*. This is the first report in Korea of the sooty mold of persimmon caused by the said fungus.

Keywords : *Cladosporium cladosporioides*, persimmon, sooty mold

Plant diseases caused by *Cladosporium* widely occur on vegetables, fruits, and even some field crops throughout the world. In particular, the diseases are commonly observed on persimmon (*Diopyros kaki* var. *domestica* Makino) during transport, storage, and marketing in boxes. On shelves in the market, the fungus produces noticeable dark green or dark gray mycelia on the affected tissues, which is a typical sign of *Cladosporium* disease. The fungus requires cool, damp weather for vivid growth, sporulation and release, germination, and disease establishment. The sooty mold disease caused by *Cladosporium* spp. covers only the surface of the plant without deep penetration, and interferes with photosynthesis. The ectoparasitic colonization of the fungus promotes infection by other parasitic and saprophytic organisms (Agrios, 1997).

During transport, storage, and marketing in boxes, a

disease suspected as sooty mold was found on persimmon (cv. Hachiya) from the Jinju City Agricultural Products Wholesale Market in Gyeongnam province. Infection rate was 6.4% in each box. The causal fungus mostly penetrated fruit tissues through wounds incurred during harvesting, strong winds, or ankertrass. Symptoms of the sooty mold on persimmon fruit are shown in Fig. 1A and B.

Diseased fruits were collected from the markets and conidia of the causal agent were directly isolated from the dark green mycelial mass. The fungus was incubated on potato dextrose agar (PDA) in the dark at 20°C and the mycological characteristics of mycelia, conidia, and conidiophores were carefully observed under a light microscope. Pathogenicity of the causal fungus on persimmon fruit was examined by artificial inoculation.

Mycological characteristics of the pathogenic fungus isolated in this experiment were compared with descriptions from previous reports. The colony, conidia, and conidiophores were measured with a microscope image analysis program. Colonies on PDA were densely packed and had dark green or dark gray color and were 1-2 μm in size (Fig. 1D). The conidia were formed often in single- or long-branched chains, and were variable in shape and size, mostly lemon shaped but sometimes ovoid to cylinder, blastophores, dark, and one-celled. The one-celled conidia were 46-132 μm in size (Fig. 1E). The conidiophores were tall, dark, upright, branched variously near the apex, clustered or single, and measured about 24-364 \times 2-5 μm variable in size (Fig. 1F). The morphology and other mycological characteristics were almost identical with the description of Udagawa et al. (1980) (Table 1). Accordingly, the *Cladosporium cladosporioides* Fres. (Barnett and Hunter, 1986; Gobayashi et al., 1992; Kitagima 1989; Udagawa et al., 1980) isolate was identified.

The maximum, optimum, and minimum temperatures for mycelial growth were 30°C, 20°C, and 5°C, respectively. Naturally, the persimmon sooty mold disease prevailed in low temperature and high humidity. The fungus successfully induced the typical sooty mold symptoms when the fungal conidia of $3 \times 10^5/\text{mL}$ was artificially inoculated to persimmon fruits either with or without wounds. Early

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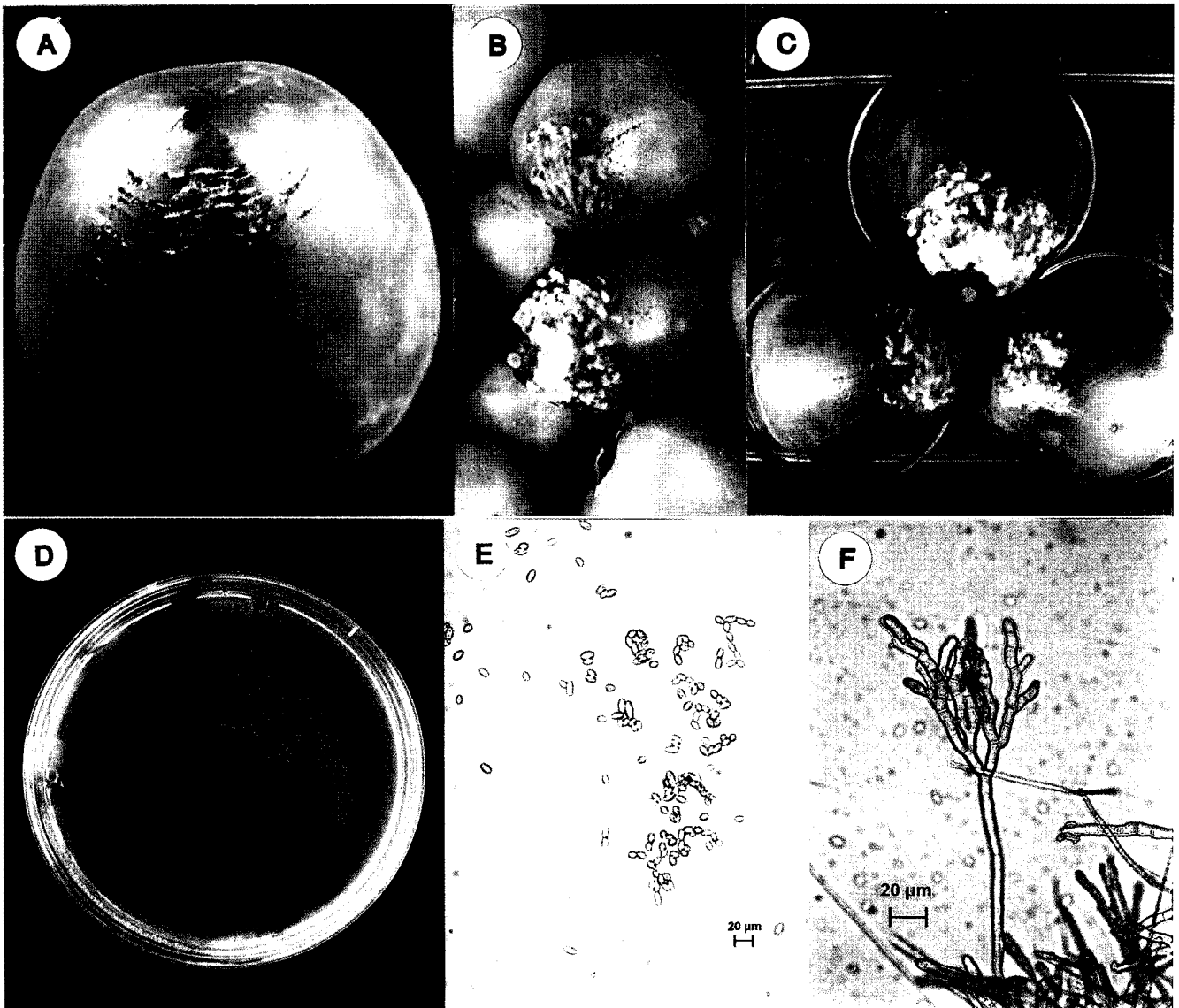


Fig. 1. Symptoms and morphological characteristics of sooty mold of persimmon (*Diospyros kaki*) caused by *Cladosporium cladosporioides*. (A) Typical symptoms with dark green fungal mats on naturally infected fruit surface; (B) Symptoms observed in boxes; (C) Symptoms induced by artificial inoculation; (D) Colony of *C. cladosporioides* on potato dextrose agar 29 days after incubation; (E) Conidia; (F) Conidiophore.

symptoms of fruits appeared 4 days after inoculation (Fig. 1C). The fruits in the box softened and eventually shrunk. The symptoms on the artificially infected fruits were almost identical to those of naturally infected fruits. The causal fungus, *C. cladosporioides*, was re-isolated from inoculated persimmon. Morphological characteristics of re-isolated fungus were the same as those naturally infected by *C. cladosporioides*.

Cladosporium herbarum (Link ex Fr.), which has a wide host range in Japan, has been known as an important pathogen in persimmon during the growing season. Sooty molds of persimmon caused by other fungi such as

Aureobasidium pullulans, *Capnophaeum fuliginodes*, *Microxyphium* sp., *Scorias communis*, *Tripospermum juglandis*, and *Alternaria* sp. have also been reported (Kitagima, 1989; Kishi, 1998; The Phytopathological Society of Japan, 2000). However, *C. cladosporioides* was reported only on rice. Although, *Cladosporium* spp. has been reported as the pathogen of 29 host species, *C. cladosporioides* on persimmon during storage has not been reported in Korea (The Korean Society of Plant Pathology, 1998). Identification of the causal fungus of sooty mold on persimmon fruits was confirmed by Centraalbureau voor Schimmelcultures (CBS) in The Netherlands. Further

Table 1. Comparison of morphological characteristics of the pathogenic fungus isolated from sooty mold disease of persimmon (*Diopyros kaki*) and *Cladosporium cladosporioides* described by Udagawa et al. (1980)

Characteristic	Present isolate	<i>C. cladosporioides</i> ^a
Colony		
color	dark green	dark green
size	1-2 μm	1-2 μm
Conidia		
size	46-132 μm	50-120 μm
shape	blastophores, ovoid, lemon, cylinder	blastophores, ovoid, lemon, cylinder
Conidiophores		
shape	branched variously near the apex, clustered or single	branched variously near the apex, clustered or single
size	24-364 \times 2-5 μm	28-380 \times 2.5-3.5 μm

^aDescribed by Udagawa et al. (1978).

confirmation of the fungal identification was done with assistance from Dr. Seung-Beom Hong of the Korean Agricultural Culture Collection (KACC), National Institute of Agricultural Biotechnology (NIAB), Rural Development Administration (RDA), Korea.

Environmental conditions such as low temperature and high humidity during the growing season of persimmon are

favorable for *C. cladosporioides* to penetrate fruit tissues through ankertrass or wounds incurred during transport, storage, and marketing.

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