

## Soft Rot of Eggplant (*Solanum melongena*) Caused by *Choanephora cucurbitarum* in Korea

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In April 2002 and 2003, soft rot on fruit of eggplant (*Solanum melongena*) caused by *Choanephora cucurbitarum* was observed in the experimental fields at Gyeongsangnam-do Agricultural Research and Extension Services in Korea. The disease began with water-soaking and dark-green lesions, and then the infected tissues were rapidly rotten. Sporangium was subglobose in shape and sized 40–130  $\mu\text{m}$ . Monosporous sporangia were elliptic, fusiform or ovoid, brown in color, and measured as 12–20  $\times$  6–14  $\mu\text{m}$ . Sporangiospores having three or more appendages were elliptic, fusiform or ovoid in shape, dark brown or brown in color, and sized 14–20  $\times$  7–16  $\mu\text{m}$ . The fungus grew well on potato dextrose agar between 15 and 40°C and its optimum growth temperature was 30°C. Based on morphological characteristics, the causal fungus of the fruit soft rot of eggplant was identified as *C. cucurbitarum*. This is the first report on the soft rot of *S. melongena* caused by *C. cucurbitarum* in Korea.

**KEYWORDS:** *Choanephora cucurbitarum*, Eggplant, Soft rot, *Solanum melongena*

Eggplant (*Solanum melongena*) has been cultivated in the southern part of Korea as one of exporting crops to Japan. During a disease survey on eggplant from 2002 to 2003, a severe fruit soft rot on the plant was observed in the experimental field of Gyeongsangnam-do Agricultural Research and Extension Services in Korea. Infection rate of the diseased fruit was about 2.6% in two fields surveyed.

Some fungi belonging to Zygomycetes are known to infect various plants, especially plant products. The genus *Choanephora*, a member of Zygomycetes is known to attack withering floral parts of many plants after fertilization and invades the fruits, causing a soft rot of primarily summer squash or pumpkin, pepper and okra (Agrios, 1997). However, plant diseases caused by the Zygomycetous fungi have not been studied much in Korea. Only recently, the authors reported various diseases caused by *Choanephora cucurbitarum*, such as blossom blight of petunia (Kwon *et al.*, 2001), pod rot of cowpea (Kwon *et al.*, 2001), flower rot on cotton rose (Kwon and Park, 2002).

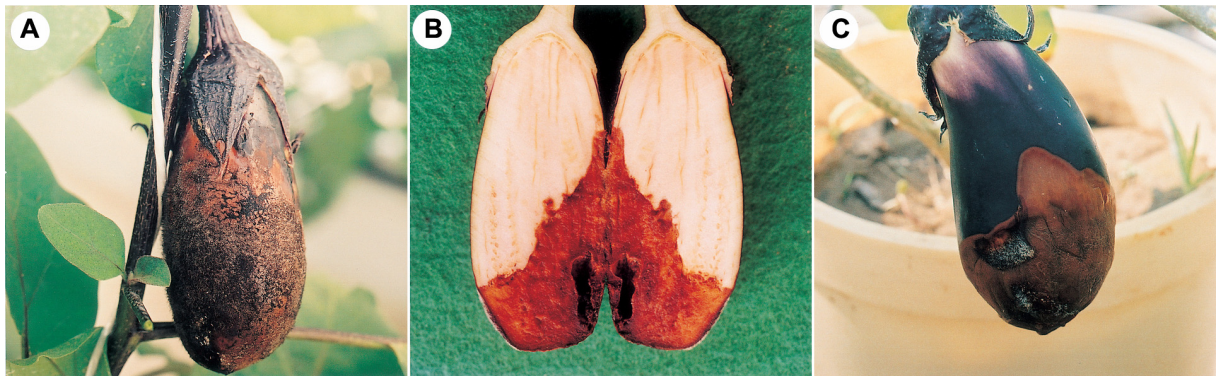
**Symptoms.** Typical symptoms of the soft rot on eggplant fruit started with water-soaking and dark-green lesions. After infection the diseased tissues were rotten rapidly under favorable environmental conditions (Fig. 1A). The pathogen penetrated mainly through wounds on the fruit and rotted rapidly. Most infected fruits showed

severely inner tissues (Fig. 1B). Usually whitish mycelia and monosporous sporangia were produced on the lesions. The disease was severe under a high temperature and humid conditions that favor the disease development. It was often observed in the fields that the fruit surface was covered by the fungal hyphae and abundant sporangia and sporangiospores. The symptoms were similar to the soft rot caused by *Rhizopus* spp. or *Mucor* spp.

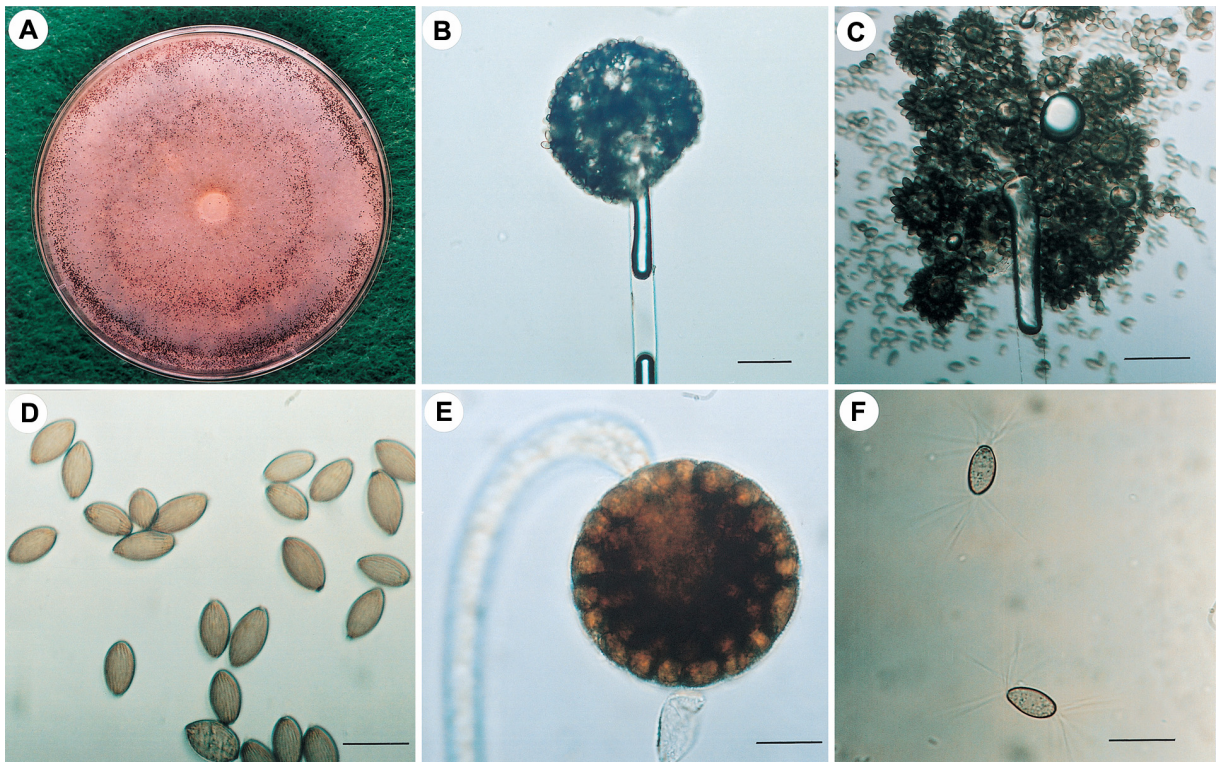
**Pathogen isolation.** Fruits of eggplant showing soft rot symptom were collected from the greenhouses located at Gyeongsangnam-do Agricultural Research and Extension Services in 2002 and 2003. The infected fruits (cv. Chukyung) were cut into small pieces for isolation of the causal pathogen. The small pieces sized 5  $\times$  5 mm were disinfected with 1% NaOCl solution for 1 minute, placed on water agar (WA), and left for 48 hrs at 24°C. The fungal tip growing out from the tissues were transferred to potato dextrose agar (PDA) for further study. A total of 50 fungal isolates were collected from the diseased fruit of eggplants. Cultural morphology of the pathogen was determined on PDA 4 days after inoculation at 30°C.

**Mycological characterization.** The fungal colonies on PDA were white to pale yellowish brown. Abundant monosporous sporangia were readily formed on the medium (Fig. 2A). Sporangia were subglobose in shape and 40–130  $\mu\text{m}$  in size (Fig. 2B). Monosporous sporangiochore was long slender and branched at the apex and each branch beared a head of sporangiospores (Fig. 2C).

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**Fig. 1.** A symptom of fruit soft rot of eggplant caused by *Choanephora cucurbitarum*. A: A typical symptom of the soft rot of eggplant fruit with marginal water-soaked lesions, B: Inner soft rot of the infected fruit, C: A symptom induced by artificial inoculation.



**Fig. 2.** Mycological characteristics of *Choanephora cucurbitarum*, the causal organism of fruit soft rot of eggplant. A: Cultural pattern on PDA, B: Monosporous sporangium, C: Cracked monosporous sporangium, D: Monosporous sporangiospores, E: Sporangium and sporangiophore, F: Sporangiospores with appendages, Scale bars: 20  $\mu\text{m}$ .

Monosporous sporangiola were elliptic, fusiform or ovoid, pediculate, striate, and measured  $12\text{--}20 \times 6\text{--}14 \mu\text{m}$  (Fig. 2D). Sporangiospores attached three or more appendages. Sporangiospores were elliptic, fusiform or ovoid in shape, light brown or dark brown in color and sized  $14\text{--}22 \times 7\text{--}10 \mu\text{m}$  (Fig. 2E, F, Table 1). Zygospores were not observed in this study. Growth temperature of the fungus ranged from 15 to 40°C and optimum growth temperature was recorded about 30°C on PDA. The fungus grew rapidly on PDA to cover the whole Petri dish (9 cm in diam.) within 36 hrs. Mycological characteristics of the fungus

investigated in this study were almost identical to those of *Choanephora cucurbitarum* (Berk & Ravenel) Thaxt. previously described (Agris, 1997; Gobayashi *et al.*, 1992; Farr *et al.*, 1995; Udagawa *et al.*, 1980). Accordingly, the causal fungus of the soft rot of eggplant fruit was identified as *C. cucurbitarum*.

**Pathogenicity test.** To examine the fungal pathogenicity to fruits of eggplant, plants were cultivated in sterilized soil in 1/5000a Wagner pots for 46 days. Conidial suspension of an isolate was prepared from 4-day-old cul-

**Table 1.** Comparison of mycological characteristics between the present isolate and *Choanephora cucurbitarum* described previously

Characteristics	Present isolate		<i>C. cucurbitarum</i> <sup>a</sup>
Sporangium	shape	subglobose	subglobose
	size	40~130 $\mu\text{m}$	50~120 $\mu\text{m}$
Sporangiospore	shape	elliptic, ovoid having appendages, striate	elliptic, ovoid having appendages, striate
	color	light brown	light brown
	size	14~20 $\times$ 7~16 $\mu\text{m}$	18~24 $\times$ 9~14 $\mu\text{m}$
Monosporous sporangium	shape	elliptic, ovoid, pediculate, striate	elliptic, ovoid, pediculate, striate
	size	12~20 $\times$ 6~14 $\mu\text{m}$	15~22 $\times$ 9~12 $\mu\text{m}$
Zygosporangium	shape	not measured	subglobose, hemispherical
	color	not measured	black
	size	not measured	50~90 $\mu\text{m}$

<sup>a</sup>Described by Udagawa *et al.* (1978).

ture on PDA. Concentration of conidia was adjusted to  $3 \times 10^5/\text{ml}$  by using a hemocytometer and spray-inoculated (50 ml/fruit) to artificially wounded eggplant fruits. The inoculated plants were placed in a humid chamber with 100% relative humidity at 30°C for 24 hrs and returned to the greenhouse until end of experiment. Typical symptoms of the soft rot appeared at 8 days after inoculation on eggplant fruit. Symptoms developed on the inoculated fruit were similar to those observed in the fields (Fig. 1C). The fungus was re-isolated from the diseased eggplant fruits. The soft rot of eggplant fruit caused by *C. cucurbitarum* is recorded in the USA (Farr *et al.*, 1995) and in Japan (Kishi, 1998; The Phytopathological Society of Japan, 2000). However, the disease has never been reported in Korea previously (The Korea Society of Plant Pathology, 2004).

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