

Note

Scab of Balsam Pear (*Momordica charantia*) Caused by *Cladosporium cucumerinum* in Korea

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During winter season of 2004 to 2006, a scab disease on balsam pear (*Momordica charantia*) caused by *Cladosporium cucumerinum* was observed in Daesan-myon, Changwon-city, Gyeongnam province, Korea. The disease symptom started with small dark brown speck on the fruits and leaves then the lesions expanded and spreaded irregularly. The aggregated mycelial mass and conidia of the fungus formed sooty scab. The colony of purely isolated fungus grew in greenish black to velvety on potato dextrose agar (PDA). Conidia were ellipsoidal, fusiform or subspherical, mostly one-celled but occasionally septated and 3~32×2~6 µm in size. The conidiophores were erected and had long branch, chains pale olivaceous brown in color and 6×280 µm in size. Ramoconidia were 10~34×3~8 µm in size. The fungus was identified as *Cladosporium cucumerinum* based on the morphological characteristics. The pathogenicity of the fungus was confirmed according to Koch's postulate. The optimum temperature of the isolate was about 20°C. This is the first report on scab of balsam pear caused by *C. cucumerinum* in Korea.

Keywords : Balsam pear, *Cladosporium cucumerinum*, *Momordica charantia*, Scab

The cultivation of balsam pear (*Momordica charantia*) is increasing in Gyeongnam area in recent years. All the fruits of balsam pear produced in this area are exported to Japan and the price is quite attractive to farmers. Generally balsam pear is cultivated in vinyl house all the year round except hot summer. From the late autumn to winter season, scab of balsam pear occurs sporadically in the vinyl house but sometimes the disease is so severe that no marketable fruits is expected thereafter. During the winter season from 2004 to 2006, the scab disease continuously occurred most of cultivation area in Daesan-myon, Changwon-city, Gyeongnam province. The disease becomes important for balsam pear cultivation.

The scab diseases caused by *Cladosporium cucumerinum*

are not rare in other crops in world wide. In Korea, several diseases occurred in other host plants have been already reported (Cho et al., 1997; Kwon et al., 1999a, 1996b, 2000; Lee et al., 1997), but not in balsam pear. Previously three kinds of disease of balsam pear were recorded in Korea; mosaic virus (*Cucumber mosaic virus*), powdery mildew (*Oidium* sp.), and leaf spot (*Phoma* sp.) (The Korean Society of Plant Pathology, 2004). Recently, two more diseases of balsam pear were reported. One was leaf spot caused by *Corynespora cassiicola* and the other was soft rot by *Rhizopus stolonifer* (Kwon and Jee, 2005; Kwon et al., 2005).

The genus *Cladosporium*, the mitosporic fungus, includes quite diverse species and cause many important diseases in different species of host. They include the leaf mold disease of tomato caused by *C. fulvum*, scab and gummosis of cucumber caused by *C. cucumerinum*, peach scab and twig blight caused by *C. carpophilum*, pecan scab and leaf spot caused by *C. caryigenum*, and pod rot and blight of pea and southern pea caused by *C. cladosporioides* (Agrios, 2005). The pathogenic fungus, *C. cucumerinum*, favors low temperature and high humidity. The fungus requires cool, damp weather for vigorous mycelial growth and sporulation. The spore germination and release also require high humidity. Consequently, infection and development of the disease actively proceed during the late autumn and early spring.

Field survey and isolation. The vinyl houses in Daesan-myon, Changwon city where the balsam pear is intensively cultivated, were surveyed every month from October 2004 to April 2005. The scab disease started to occur from the lower leaves and fruits in late October and spreaded quickly to upper parts and neighboring plants under the cool and humid condition in vinyl house. The new disease was not severe in December and January, the coldest season, but it spread vividly again in February and March. Generally, the temperature of vinyl house in April already was too high on the development of the disease. No more disease establishment occurred thereafter. Average rate of infected plant in a vinyl house observed in February 2005 was about 16%.

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Freshly infected leaves were collected from the balsam pear fields and cut into small pieces for isolation of the causal organism. Fifty pieces of leaf tissues sized 5×5 mm were sterilized with 1% NaOCl solution for 1 minute and placed on potato dextrose agar (PDA). Fungal mycelial tips grew out from the leaf tissues were transferred to fresh PDA and incubated for 5 days at 20°C. The fungal colonies formed on PDA were used for the observation of mycelial growth pattern and conidial development.

Symptoms. The symptom was appeared superficially on the leaves, fruit and stem and, sometimes all over the balsam pear plant (Fig. 1A, B, C). Symptoms on leaf, fruit and stem were started with water soaked lesion and fungal mycelia or conidia grew on the plant surface and irregularly formed greenish to black or dark brown sooty scab lesions.

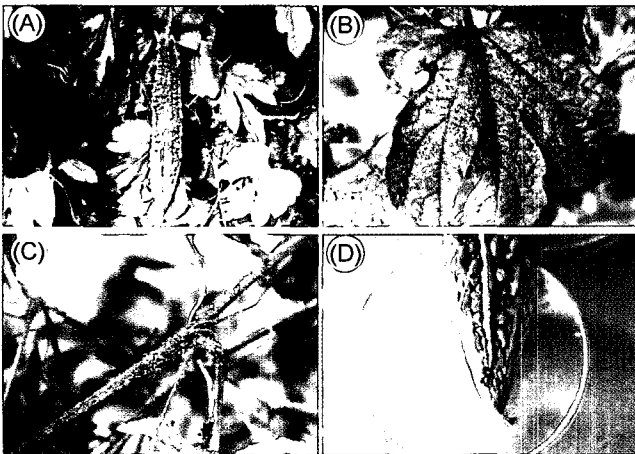


Fig. 1. Symptoms of scab appeared on balsam pear (*Momordica charantia*) caused by *Cladosporium cucumerinum*. Dark brown fungal mass on fruit surface (A), typical sooty symptom on leaves (B) and stem (C), and symptoms induced by artificial inoculation (D).

In artificially inoculated plants, the lesions were mostly developed on fruits and leaf with dark sootiness. The causal fungus of scab disease of balsam pear covered surface of tissues without further deep penetration inside tissues. The superficial growth of the fungus blocks light and gas exchanges of plant, causes interference of photosynthesis, then lead to the growth of other saprophytic organisms.

Identification. Purely isolated fungal isolate were cultured on potato dextrose agar at 20°C in dark condition. Mycelia, conidia, ramoconidia and conidiophores were observed under the scanning electron microscope.

Colonies on PDA were densely packed with greenish black or velvet in color. The conidiophore was pale olivaceous brown, tall, smooth, upright, dark, branched variously near the apex, clustered or single, and was variable 6×280 μm in size (Fig. 2A). The ramoconidia were formed on the conidiophores as branch type bearing chain of conidia. They were septated 0~2 and their size were 10~34×3~8 μm. The conidia were formed in long branched chains, and they were varied in size and shape. The most of conidia were ovoid to cylindrical but sometimes typical lemon shape, subspherical, fusiform or irregular form. They were mostly single-celled, but occasionally 1-septate. The conidium was 3~32×2~6 μm in size (Fig. 2B). The mycological characteristics of the causal fungus isolated from scab disease of balsam pear were compared with *Cladosporium cucumerinum* described by previous worker (Table 1). The growth temperature of the fungus was 18~30°C and the optimum growth temperature was 20°C. The fungus did not show any growth at temperature over than 35°C. The morphological characteristics of the fungus were almost identical to *C. cucumerinum* (Barnett and Hunter, 1986; Ellis and Holliday, 1972; Ujioa and Hanlin, 2000). Accordingly, we identified the casual fungus as *Cladosporium cucumerinum* Ellis & Arthur.

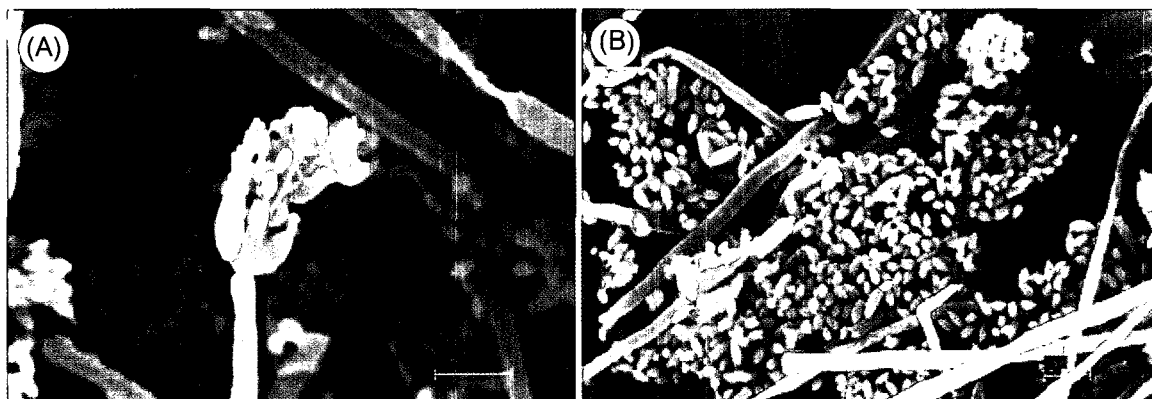


Fig. 2. Scanning electron microscopy of morphological characteristics of *C. cucumerinum*, the causal fungus of scab disease of balsam pear (*Momordica charantia*) (A) Conidophore and ramoconidia bearing conidia. (B) Detached ramoconidia and conidia.

Table 1. Comparison of mycological characteristics of pathogenic fungus of scab disease of balsam pear (*Momordica charantia*) and *C. cucumerinum* described by Ellis and Holliday

Characteristics	Present Fungus	<i>C. cucumerinum</i> ^a
Colony	greenish black, velvety	greenish black, velvety
Conidia		
color	pale olivaceous brown	pale olivaceous brown
size	3~32 × 2~6 µm	4~25 × 2~6 µm
septa	0~1	0~1
shape	ellipsoidal, fusiform	ellipsoidal, fusiform
Ramoconidia		
color	pale olivaceous brown	pale olivaceous brown
size	10~34 × 3~8 µm	30 × 3~5 µm
septa	0~2	0~2
Conidiophore		
color	pale olivaceous brown	pale olivaceous brown
length	6~280 µm	8~400 µm
width	3~6 µm	3~5 µm

^aDescribed by Ellis and Holliday (1972).

Pathogenicity test. Conidial suspension of the fungal isolate was prepared from PDA (12 days old) cultures, and adjusted to 3×10^5 conidia/ml by using a hemacytometer. Fruits of balsam pear were spray-inoculated with the spore suspension without wound. Inoculated fruits were placed in a plastic humid chamber (29×22×15 cm) with 100% relative humidity at 20°C for 24 hours. Then the inoculated fruits were placed on laboratory bench at room temperature. Typical symptoms on the fruits of balsam pear (*M. charantia*) were appeared at seven days after inoculation (Fig. 1D). The symptoms were almost identical to those of the natural infection. The fungus was re-isolated from the lesions of inoculated fruits and confirmed to the same fungus that we inoculated.

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