Plant Pathol. J. 16(6) : 318-320 (2000)

The Plant Pathology Journal
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Silver Scurf of Potato Caused by *Helminthosporium solani*

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(Received on May 10, 2000)

Potato tubers with silver scurf lesions were collected from the cold storage at Pyungchang, Kangwon province in Korea. The causal agent of the silver scurf was identified as *Helminthosporium solani* by mycological characteristics of conidia and conidiophores. Pathogenicity of the fungus was confirmed by artificial inoculation on the potato tuber. This is the first report of potato silver scurf by *Helminthosporium solani* in Korea.

Keywords : potato, silver scurf, *Helminthosporium solani*, storage.

Silver scurf, caused by *Helminthosporium solani* Durieu& Mont., is one of important storage diseases of potato (*Solanum tuberosum* L.), but has not been reported in Korea (The Korean Society of Plant Pathology, 1998). Potato tubers showing silver scurf symptom were found in the cold storage at Daekwallryung in Kangwon province, Korea, during the disease survey from February to April in 1997 and 1999. Disease incidence of potato silver scurf ranged from 3 to 30% in the cold storage (Table 1). Disease symptoms increase greatly during long term storage of tubers as a result of lesion expansion and repeated cycles of sporulation. Lesions are often clustered at the stem end of the tuber and attributed to the air pockets that develop in the periderm as a result of the cellulolytic activity of *H. solani*. (Fig. 1D). Moisture losses caused by rupture mat increase susceptibility of the tubers to other storage pathogens that usually require wound for infection. Also, moisture losses result in reduction of tuber fresh weight during storage and discoloration of the tuber periderm by the disease, which greatly reduced tuber marketability (Oliver et al., 1999). Infection can occur during the growing season and lesions may be visible at the time of harvest, especially when tubers are wet (Merida and Loria, 1994; Merida et al., 1994).

Table 1. Disease incidence of potato silver scurf in cold storage at Pyungchang area of Korea from February to April in 1997 and 1999

Year	No. of storage	Disease incidence (%)[a]	
		Feb. 20	April 27
1997	3	3	7
1998	3	15	30
1999	3	4	12

[a] Disease incidences were investigated on 500 tubers in each sites with bulked potato storage.

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Tissues taken from the edge of the lesion were plated on 2% water agar after surface sterilization with 1% sodium hypochlorite solution for 1 min. and incubated at 20 ± 1°C for 20 days. Hyphal tips or individual conidia from the growing mycelia on water agar were aseptically transferred to potato dextrose agar (PDA). All isolates were stored at 4°C and used for the identification and pathogenicity tests. Conidia and conidiophore produced on tuber and on PDA culture were examined by light microscope. The causal fungus was slowly grown on PDA and corn meal agar (CMA). No isolates grew and germinated under at 4°C and over at 35°C. Optimal temperature for mycelial growth was 20 and conidia were actively germinated at 15°C (Table 3). The colony color on PDA was brown to deep brown at the early stage and changed to black with cultural age (Fig. 1C).

Mycological characteristics of *H. solani* isolated from potato tubers in the cold storage were the same as the previous reports (Hooker, 1981; CMI description) (Table 2). Size of conidia was 7-11 μm to 24-85 μm and the color was conspicuously brown. The shape was obclavate, slightly curved 2-7 septate and tapered tip. Also, conidia arranged in whorls from the distal ends arising singly or in groups. Conidiophores were unbranched, turned brown with cultural age and the size was 129-160 μm in long, 9-15 μm thick near the base (Fig. 1A and B).

To prove the pathogenicity of the fungus, four varieties (Jopung, Superior, Atlantic and Irish Cobbler) produced by hydrophonic culture were used and the tubers were thoroughly washed with 70% ethanol and sterilized water. The tubers were inoculated by spraying 20 ml of inoculum solution per tuber at a concentration of 10^6 connidia/ml, then placed in dew chamber (100% relative humidity) at 20°C for 36 h before being returned to the incubator at 25°C and with relative humidity 90% until lesions appeared on tuber

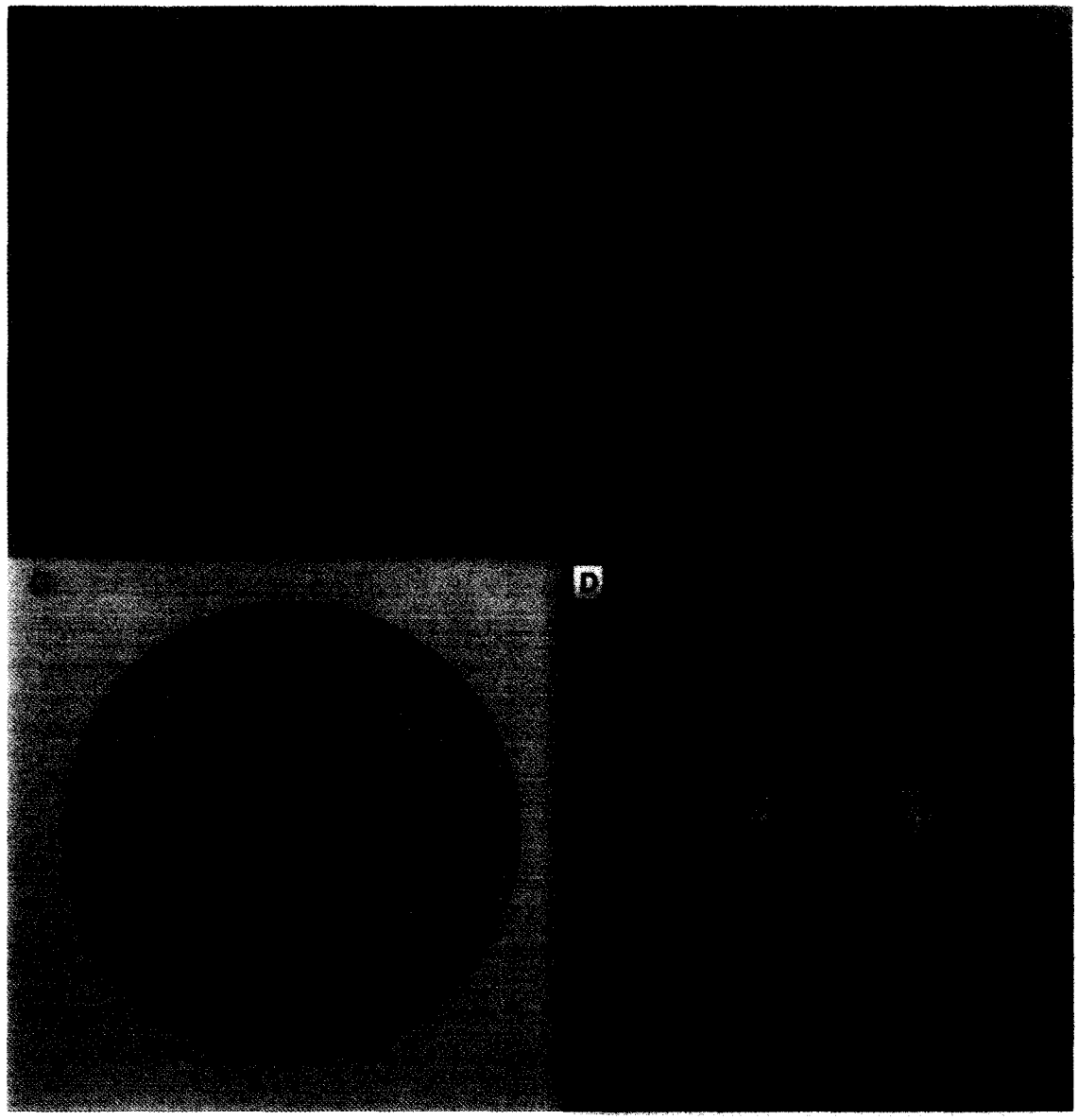

Fig. 1. A magnified picture of the conidiophore and conidia from tubers infected with silver scurf (A, B). Mycelial growth on PDA with characteristic colony color (C). The most conspicuous symptom is grayish, silvery on potato tuber (D).

Table 2. Comparsion of mycological characteristics of the isolate(TK-11) with *Helminthosporum solani* described previously

Character	Isolate (TK-11)	*H. solani* Dur. & Mont.[a]
Conidia size shape	711 μm × 2485 μm tapered tip, brown color, obclavate, smooth, straight, slightly curved 2-7 septate arranged in whorls from the distal ends arising singly or in groups	7-11 μm × 2485 μm tapered tip, brown color, obclavate, smooth, 2-8 pseudoseptate arranged in whorls from the distal ends arising singly or in groups
Conidiophores	129-160 μm long, 9-15 μm thick near the base unbranched and turn brown with age	120-600 μm × 9-15 μm (base) 120-600 μm × 6-9 μm (apex) brown to dark brown
Temperature	opt. 20-28°C, 4-31°C	"
Colony pattern	dark brown to black	"

[a] CMI descriptions of Pathogenic Fungi and Bacteria No. 166.

Table 3. Mycelial growth and sporulation of *Helminthosporium solani* at 14 days after incubation in various temperature

Temperature (°C)	Mycelial growth (mm ± SE)		Sporulation (% ± SE)	
	PDA	CMA	PDA	CMA
5	5.0 ± 0.15	2.5 ± 0.12	2.8 ± 1.14	4.5 ± 1.20
10	9.5 ± 1.21	7.5 ± 0.53	14.3 ± 2.19	13.8 ± 0.38
15	14.0 ± 1.29	12.5 ± 1.10	67.3 ± 5.0	78.4 ± 2.22
20	21.0 ± 0.5	18.5 ± 0.22	47.5 ± 0.31	70.1 ± 1.18
25	18.0 ± 1.23	13.5 ± 1.15	16.2 ± 5.0	28.4 ± 1.63
28	15.5 ± 1.15	10.5 ± 0.91	6.1 ± 2.28	10.1 ± 0.50
32	4.0 ± 0.2	2.5 ± 0.1	3.4 ± 1.20	8.2 ± 0.23

Table 4. Pathogenicity of *Helminthosporium solani* isolate on potato tubers by artificial inoculation

Cultivar	Tested tuber	No. of infected tuber	Disease Severity[a]
Jopung	20	8	++
Superior	20	4	+
Atlantic	30	7	++
Irish Cobbler	20	4	+
Control	30	0	–

[a]Disease severity was rated at 40 days after inoculation.
++: abundant lesions, +: a few lesions, –: no symptom.

surface. Conidial suspensions were prepared from 20 days old PDA culture. then diluted with distilled water to adjust conidia concentration to 10^6/ml. Disease incidence was recorded by the percentage of infected tubers and severity was estimated by the degree of symptom development on the tuber surface at 40 days after inoculation. Isolates were produced the typical silver scurf lesions on the tuber at 26 days after inoculation and the area was enlarged on the tuber surface with cultural age. Of four varieties, Jopung was more severe infection than other varieties (Table 4). Reisolation of the pathogen from the lesions on the tuber was conducted as described above.

The fungus, *Helminthosporium solani*, is often seed borne. In most case, seed potatoes do not show the characteristic silvery lesion on the skin because seed storage temperature of 4°C is not conductive for fungal growth. However, the fungus will survive in the skin of the potato at this temperature and remains latent until conditions become favorable for sporulation and spread. Therefore, the use of an effective seed treatment may be important in the management of silver scurf on potatoes. It needs further information on the development of efficient chemicals against silver scurf of potato. This is the first record of a potato silver scurf by *Helminthosporium solani* in Korea.

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