

Note

Phytophthora Rot of Broad Bean (*Vicia faba*) Caused by *Phytophthora nicotianae* in Korea

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Phytophthora rot on broad bean (*Vicia faba*) occurred in the experimental field at Gyeongsangnam-do Agricultural Research and Extension Services from 2004 to 2006. The fungus isolated from the diseased plants grew well on potato dextrose agar and showed an arachnoid or rosaceous colony pattern. Sporangia were conspicuously papillated, noncaducous, ovoid to globose, and 25-64×18-44 µm in size. Oogonia and oospores were spherical and measured as 20-32 µm and 16-28 µm in size, respectively. Oospores were relatively small and aplerotic. Antheridia were amphigynous, spherical, and unicellular. Chlamydospores were globose and 18-40 µm in size. Optimum temperature for growth was about 28°C on potato dextrose agar. The disease occurred in all parts of the plant including roots, stems, leaves and pods in the field. The symptoms similar to those of naturally infected plants were induced by artificial inoculation and the pathogen was re-isolated from the plant. On the basis of mycological and pathological characteristics, the causal pathogen of broad bean rot was identified as *Phytophthora nicotianae*. This is the first report of Phytophthora rot of broad bean caused by *P. nicotianae* in Korea.

Keywords : broad bean, Phytophthora rot, *Phytophthora nicotianae*, *Vicia faba*

Broad bean (*Vicia faba*) belong to *Leguminosae* was originated from middle Asia and Mediterranean Sea. Generally, broad bean is cultivated from October to June in open fields of Korea. From 2004 to 2006, Phytophthora rot on broad bean caused by *Phytophthora nicotianae* was observed in the experimental fields at Gyeongsangnam-do Agricultural Research and Extension Services. The disease occurred mainly on roots, stems, leaves and pods of the plant. Until now, five diseases on broad bean; powdery mildew (*Oidium* sp.), leaf spot (*Alternaria tenuissima*), red spot

(*Botrytis fabae*), rust (*Uromyces viciae-fabae*), and gray mold (*Botrytis cinerea*), have been recorded in Korea (Kwon et al., 2001; Kwon and Park, 2002a; Kwon and Park, 2002b; Kwon et al., 2002; Kwon and Park, 2003). However, a number of unrecorded diseases may occur on the plant as the cultivation area increased. In fact, many important diseases impeding safe cultivation of various crops have not been studied.

Phytophthora is known as one of the most destructive plant pathogen groups. It attacks most cultivation crops worldwide (Erwin and Ribeiro, 1996). Jee (1998) and Jee et al. (2000) reported that 18 species of *Phytophthora* distributed throughout Korea attack 70 host plants. However, broad bean has not been listed as a host of the fungus in Korea yet (The Korean Society of Plant Pathology, 2004). In this study, the causal pathogen of broad bean was identified based on its mycological and pathological characteristics.

Symptoms. Phytophthora rot was observed in all parts of the plant e.g. roots, stems, leaves and pods. The rots initiated with small water-soaked lesions and the infected plants rapidly wilted and blighted eventually (Fig. 1A). The pathogen readily penetrated through wounds of pods. Under a humid weather condition white mycelial mats were formed inside or on the surface of infected pods in the fields. The heavily infected pods rapidly rotted and mummified eventually (Fig. 1B). Longitudinal section of the artificially inoculated pods showed similar symptoms observed in the field (Fig. 1C). Abundant sporangia often produced on the surfaces of infected pods, which may play an important role as the secondary inoculum source attacking aerial parts of the plant by splash in the fields.

Environmental conditions. Broad bean is cultivated from October to June in fields at Gyeongsangnam-do Agricultural Research and Extension Services. The disease started from late May and spread widely in June during the rainy season. Infection rate of pod in the field varied depend on rainfall of

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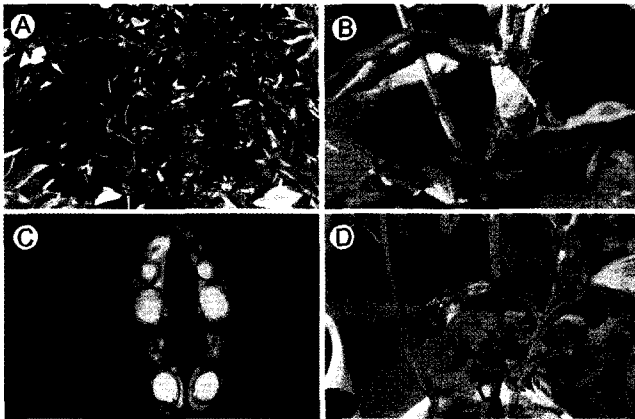


Fig. 1. Symptoms of *Phytophthora* rot of broad bean caused by *Phytophthora nicotianae*. A and B: Typical symptoms on leaves, stems and pods showing water-soaking lesion, wilt, and blight, C: Longitudinal section of artificially inoculated pod 6 days after inoculation, D: Rots on pod induced by artificial inoculation.

the year, however, it was estimated about 6% in 2005.

Mycological characteristics. Freshly infected pods were collected from the fields and cut into small pieces for isolation of the causal pathogen. The small pieces of 5×5 mm in size were disinfected in 1% NaOCl solution for 30 seconds, washed in distilled water for 3 times, and placed on both a *Phytophthora* semi-selective medium (Jee et al., 1998; 2000) and water agar. After incubation for 48 hr at 25°C, mycelial tips growing out from the tissue were cut and transferred to potato dextrose agar. The cultural colony patterns were observed on the medium after incubation for 7-10 days at 25°C. The fungus was cultured on 10% V8 juice agar to examine the sexual and asexual reproduction structures. After incubation for 5 days at 25°C, mycelial mats were cut into small blocks (1.0×1.0 cm) and submerged in distilled water for sporulation. The sporangial features were examined under a light microscope after incubation for 24 hours under light. The mycological characteristics formed on 10% V8 juice were examined under a light microscope at 400× (Table 1). Colony patterns of the isolate on PDA were arachnoid or rosaceous (Fig. 2A). The fungus grew between 5°C and 40°C and the optimum temperature was about 28°C. Sporangia were abundantly produced in water. They were mostly ovoid to globose in shape, mainly noncaducous, conspicuously papillate, and 25-64×18-44 μm in size (Fig. 2B). Chlamydo spores observed by old culture on the PDA were globose and 18-40 μm in size (Fig. 2C). Oogonia were spherical, smooth walled, and 20-32 μm in size. Oospores were aplerotic, spherical, and 16-28 μm in size (Fig. 2D). Antheridia were amphigynous, unicellular, and spherical. Mycological characteristics of the isolate matched well with *Phytophthora*

Table 1. Comparison of mycological characteristics of the causal pathogen of broad bean rot and *Phytophthora nicotianae*

Characteristics	Present isolates	<i>P. nicotianae</i> ^a
Colony	arachnoid or rosaceous	dense or loose rosette
Sporangium		
shape	papillate, noncaducous, ovoid to globose	papillate, noncaducous, ovoid to spherical
size	25~64×18~44 μm	28~66×20~48 μm
Sporangiophore	branched	branched
Oogonium		
shape	spherical, smooth wall	spherical, smooth wall
size	20~32 μm	24~34 μm
Oospore		
shape	aplerotic, spherical	aplerotic, spherical
size	16~28 μm	18~34 μm
Antheridium	amphigynous, unicellular, spherical	amphigynous, unicellular, spherical
Chlamydo spore		
shape	abundant, globose	abundant, spherical
size	18~40 μm	18~50 μm
Sexuality	heterothallic	heterothallic
Hyphal swelling	formed on agar and water	formed on agar and water

^aDescribed by Breda de Haan, J. van (1896).

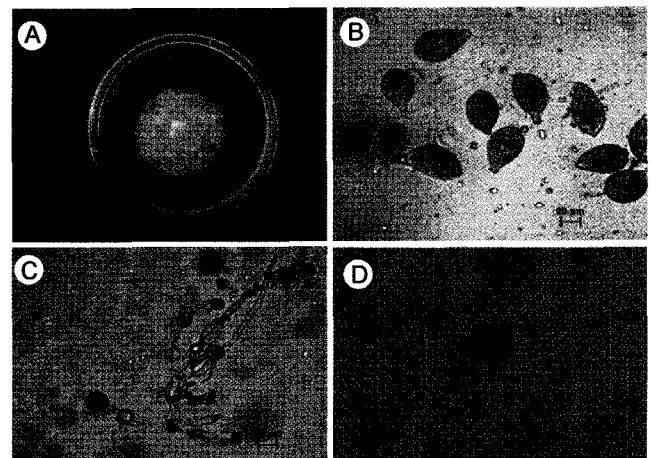


Fig. 2. Morphological characteristics of *P. nicotianae* causing various rots on broad bean. A: Arachnoid colony formed on PDA for 8 days after incubation at 25°C, B: Sporangia with short penicils, C: Chlamydo spores, D: Oospore.

nicotianae as described by Erwin and Ribeiro (1996), Jee (1998) and Jee et al. (1998; 2000). Accordingly, the causal pathogen of broad bean was identified as *P. nicotianae*.

Pathogenicity test. Broad beans grown in Wagner pots (1/5,000a) under field conditions for 180 days were used for the fungal pathogenicity test. Zoospores of the pathogen for

using in the pathogenicity test were prepared as follows. Mycelial agar blocks were cut into small pieces from 6 days old cultures grown on 10% V8 juice agar and transferred to new Petri dishes containing 20 ml of distilled water. The dishes were incubated under a fluorescent light for 24 hr at 25°C for sporulation. The Petri dishes were chilled for 1 hour at 5°C to release zoospores from sporangia. Zoospores were collected by filtering through four layers of cheesecloth and adjusted to 10⁴/ml. The zoospore suspension was fully sprayed onto the healthy pods with or without wound by a sterile pin and kept under a vinyl cover to supply 100% moisture for 24 hr. Symptoms similar to those observed in the field appeared three days after inoculation on wounded pods. In particular, water-soaked lesions appeared on wounded pods developed into severe rot within 6 days (Fig. 1D). The pathogen was re-isolated from the freshly infected lesions to prove Koch's postulate.

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