

## *Phytophthora cryptogea* Causing the Foot Rot of *Gerbera jamesonii* in Korea

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### *Phytophthora cryptogea*에 의한 거베라 역병

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**ABSTRACT :** Since 1992, a destructive foot rot of gerbera caused by a *Phytophthora* species has occurred at most cultivation areas in Korea. Infected plants showed symptoms of wilting due to the decay of main root system and were led to their eventual death. A total of 47 isolates were collected from roots and petioles of infected plants and identified as *Phytophthora cryptogea* based on morphological, cultural and physiological characters. Among 20 isolates tested, sexual types A1 and A2 were numbered 8 and 4, respectively, while the 8 remaining isolates were sterile. In pathogenicity test, none of the seven gerbera cultivars growing in Korea were resistant to the disease. *P. cryptogea* has not been reported as a causal pathogen of the foot rot of gerbera or any other hosts in Korea previously.

**Key words :** *Phytophthora cryptogea*, gerbera foot rot, identification.

**Symptoms and pathogenicity.** Gerbera plants infected by *Phytophthora* sp. showed wilting and sudden death due to the decay of main root system. While underground parts of the infected plant were rotten, water soaking lesions appeared on basal petioles, and later turned dark blue to black in color, which is a diagnostic symptom of the disease (Fig. 1A). The disease was observed at 8 major cultivation areas in Korea (Fig. 2.) and 47 isolates were collected from roots or petioles of infected plants from 1992 to 1996. In pathogenicity test, none of the seven gerbera cultivars tested under greenhouse conditions were resistant to the disease (Table 1).

**Identification of the pathogen.** The fungus grew well on common media and produced slightly to fairly fluffy aerial mycelia which had no distinct colony pattern on 20% clarified V-8 agar medium. Mycelia were uniform with main hyphae of 4.0~7.5 (av. 5.2)  $\mu\text{m}$  in width. Formation of conspicuous network of spherical hyphal swellings (<25  $\mu\text{m}$ ) was common in water but not on agar medium (Fig. 1B). Sporangia were not

commonly observed on agar but readily formed in water. Most sporangia formed either solely or in short chains were nonpapillate, obpyriform (or ovoid), non-caducous, internally proliferated, and measured 38~52 $\times$ 25~35 (av. 49 $\times$ 31)  $\mu\text{m}$  in size (Fig. 2C). Each sporangium contained a conspicuous central vacuole and a short pedicle (<5  $\mu\text{m}$ ). Sexuality of the fungus was heterothallic. However, oospores were not readily produced when paired with compatible isolates of *P. parasitica*. Oogonia developed by pairings with compatible isolates were spherical, smooth, and 28~36 (av. 32)  $\mu\text{m}$  in diameter. A spherical oospore was 25~32 (av. 28)  $\mu\text{m}$  in size almost filled oogonium (plerotic). All of the antheridia were amphigynous, unicellular, spherical to short cylindrical, and measured av. 14 $\times$ 15  $\mu\text{m}$  in size (Fig. 1D). Chlamydospores were not formed by a single isolate, however, scarcely observed when paired with *P. parasitica*. Optimum temperatures for mycelial growth and sexual reproduction were 24~28 and 15~20 $^{\circ}\text{C}$ , respectively. However, none of the isolates grew or produced oospores at under 5 $^{\circ}\text{C}$  or over 35 $^{\circ}\text{C}$  (Fig. 3). Among 20 isolates tested, 8 and 4 belonged to sexual types of A1 and A2, respectively,

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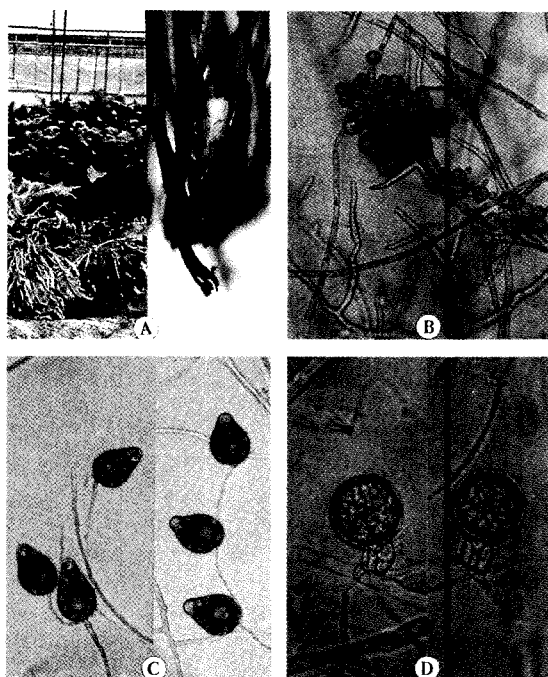


Fig. 1. Symptoms of the gerbera foot rot caused by *Phytophthora cryptogea* (A) and features of the fungus; hyphal swellings (B), sporangia (C), and oospores (D).

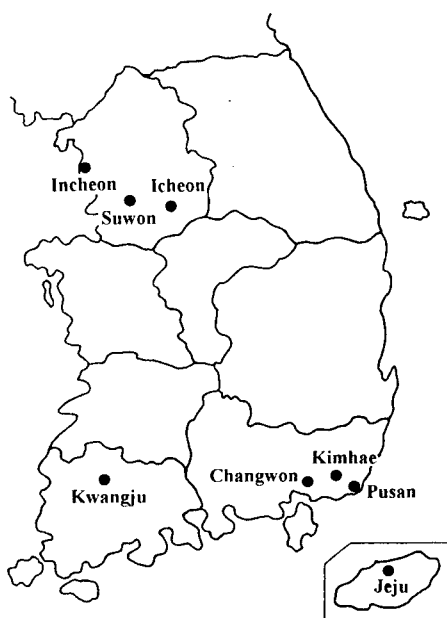


Fig. 2. Distribution of the gerbera foot rot caused by *Phytophthora cryptogea* in Korea. Black dots indicate locations in which the disease occurred and the isolates were collected.

Table 1. Pathogenicity of *Phytophthora cryptogea* to gerbera cultivars

Cultivar	Isolates		Control
	G6-2	G7-1	
Volga	++ <sup>a</sup>	++	-
Expo	++	++	-
Beauty	++	++	-
Ensopy	++	++	-
Gracia	+	++	-
Mirage	++	+	-
Hope	+	++	-

<sup>a</sup> - : no symptom, + : mild wilt, ++ : severe wilt to death.

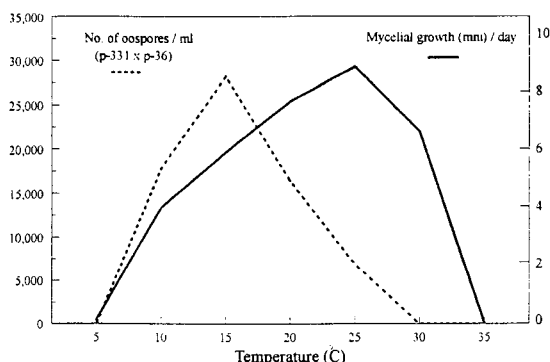


Fig. 3. Effect of temperature on growth and sexual reproduction of *Phytophthora cryptogea* (P-331 × P-36).

while 8 were sterile (Table 2).

**Discussion.** Our investigation showed that many characters of morphology and physiology of the causal fungus of the gerbera foot rot were corresponding to *P. cryptogea* or *P. drechsleri* described by Ho (1), Ho and Jong (2, 3), Kimishima and Goto (4), Stamps (7), and Stamps *et al.* (8). Because of the similarity in morphology and physiology, *P. cryptogea* and *P. drechsleri* were considered conspecific and the former has priority (3, 5). However, Ho and Jong (2) redescribed the two species conclusively and alleged that the inability to grow at 35°C was a decisive differentia of *P. cryptogea* to *P. drechsleri*. Since none of the isolates collected from affected gerberas grew at 35°C, the causal fungus of the gerbera foot rot was identified as *P. cryptogea*. *P. cryptogea* causes root rot diseases in a number of hosts of glasshouse and field crops and are distributed in many countries (6, 7). The gerbera foot rot caused by the fungus has been reported in Japan, USA, and Europe (4, 6, 7), however, it has not

**Table 2.** Mating type composition of *Phytophthora cryptogea* isolates

Field location	No. of isolates tested	Mating types		
		A1	A2	Sterile
Suwon	4	4	0	0
Incheon	2	1	1	0
Icheon	1	0	1	0
Pusan	4	1	1	2
Kimhae	6	2	0	4
Kwangju	3	0	1	2
Total	20	8	4	8

been reported previously in Korea as the causal pathogen of the gerbera foot rot and any other hosts.

## 요 약

1992년부터 국내 주요 거베라 재배지역에서 *Phytophthora*속 균에 의한 역병이 발생하였다. 이병주는 뿌리조직이 파괴되어 급격히 시들며 말라죽는데 지제부의 잎자루는 수침상으로 검게 썩는 병징을 나타낸다. 총 47개 균주를 이병주에서 분리하여 균의 형태적, 배양적, 생리적 특성 등을 조사한 결과 모두 *Phytophthora cryptogea*로 동정되었다. 각 지역에서 수집된 20개 균주중 유성생식형 A1과 A2는 각각 8 균주와 4 균주였고 8개 균주는 불임성(sterile)이었다. 병원균은 7개 거베라 품종에 모두 강한 병원성을 나타내어

품종간 차이를 관찰할 수 없었다. *P. cryptogea*는 아직 국내에 기록된 바가 없는 식물병원균으로 거베라 역병균으로 처음 보고한다.

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