

Mating Type Differentiation of *Phytophthora infestans* Isolates in Korea

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Phytophthora infestans (Mont.) de Bary is the causal agent of potato late blight. It belongs to the oomycetes and is heterothallic with two known mating types, designated as A1 and A2 (Gilgley et al., 1958). Until the early 1980's the global pathogen population consisted mostly of the A1 mating type, the A2 mating type being only found in Central Mexico. In the early '80s it was discovered that the A2 mating type had migrated to Europe and many other countries in the world (Fry et al., 1993). In some areas (Mexico, the Netherland, and Poland) where both mating types are present, sexual reproduction occur (Forbes et al., 1998). Sexual recombination can accelerate the adaptation of the population to management practices and can lead to greater variability in the population, which may lead to higher resistance to fungicides (Govers et al.,). In 1981 the A2 isolates were discovered in Switzerland (Hohl et al., 1984). Subsequently the A2 mating type isolates were identified in several countries; in Egypt (El-Korany et al., 1998), the United Kingdom (Tantius et al., 1986), Germany (Shoeber et al., 1986), Sweden (Kadir et al., 1987), the Netherlands (Frinking et al., 1987), Japan (Ogoshi et al., 1988), Israele (Grinberger et al., 1989), and Brazil (Castro et al., 1989). Additionally, the A2 mating type was reported by Koh et al. (1994), and Lee et al. (1994) in Korea. Before the new A2 mating type spread, the fungus was assumed to come from mutation or parasexual recombination in strain of A1mating type. Some of the new strains were fitter than the original strain under the unstable condition and replaced the originally disseminated A1 strain. During 1998-2000, a number of isolates of *P. infastans* were collected from potato plants in major growing areas of Korea and determined the mating types.

Determination of mating type

A1 mating type isolate AC-1 and A2 mating type isolate BC-3 of *Phytophthora infestans* were used as the testers. The mating type of each single-sporangial isolate of *P. infestans* was determined by pairing a small piece of culture with the same size culture of the A1 mating type or A2 mating type tester about 5 mm apart on V-8 rye agar block in a petri plate. After incubation at 20°C in darkness for 5-10 days, agar block were examined microscopically. Those isolates that formed oospores when paired with A2 mating type tester were designated as being A1 mating type ; those that formed oospores when paired with A1 mating type tester were designated as being A2 mating type.

Frequency of mating type of *Phytophthora infestans* during 1998-2000

During 1998-2000, we collected about three hundred isolates of *P. infestans* from potato plants in Korea and determined the mating types. In 1998, forty-two isolates of recovered from diseased potato leaves were collected from the Gangwon province of Korea. 27 isolates (64.3%) were A1 mating type, and other isolates (37.5%) were A2 mating type (Table 1). All isolates were either resistant or intermediate in response to 10 µg/mL of metalaxyl (data not shown).

Table 1. Frequency of mating types for *Phytophthora infestans* isolates obtained from Gangwon province in 1998

Location	Isolates	Mating Type	
		A1	A2
Hoenggae	11	2(18.2) ^a	9(81.8)
Jinbu	11	8(72.7)	3(27.3)
Wansan	4	3(75.0)	1(25.0)
Gangnung	16	14(87.5)	2(12.5)
Total	42	27(64.3)	15(35.7)

^a Percentage of mating type isolates.

In 1999, 130 isolates from diseased potato leaves were collected from the Gangwon, Gyeongnam, Cheonbuk, and Cheju province of Korea. 117 isolates (90%) were A1 mating type, and other isolates (10%) were A2 mating type (Table 2). All but six isolates were either sensitive or intermediate in response to 10 µg/mL metalaxyl. The six isolates were resistant to metalaxyl (data not shown).

Table 2. Frequency of mating types for *Phytophthora infestans* isolates obtained from various locations in 1999

Location	Isolates	Mating Type	
		A1	A2
Hoenggae	10	9(90) ^a	1(10)
Jinbu	7	7(100)	0(0)
Wansan	10	10(100)	0(0)
Gangnung	78	78(100)	0(0)
Milyang	4	1(25.0)	3(75.0)
Gimje	7	0(0)	7(100)
Namwon	12	12(100)	0(0)
Cheju	2	0(0)	2(100)
Total	130	117(90)	13(10)

^a Percentage of mating type isolates.

In 2000, 98 isolates from diseased potato leaves were collected from the Gangwon, Cheonbuk, and Cheju province of Korea. 83 isolates (84.7%) were A1 mating type, and other isolates (15.3%) were A2 mating type (Table 3). The 116 isolates varied in their resistance to metalaxyl, but the majority of the isolates were sensitive (98 isolates) in response to 10 µg/mL metalaxyl. The other isolates were resistant (14 isolates) or intermediate (13 isolates) to metalaxyl (data not shown).

Table 3. Frequency of mating types for *Phytophthora infestans* isolates obtained from various locations in 2000

Location	Isolates	Mating Type	
		A1	A2
Pyongchang	18	16(88.9)	2(11.1)
Gangnung	16	16(100)	0(0)
Namwon	4	4(100)	0(0)
Cheju	14	1(7.1)	13(92.9)
Total	98	83(84.7)	15(15.3)

^a Percentage of mating type isolates.

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