

LATE BLIGHT SCENARIO IN WESTERN UTTAR PRADESH AND CHARACTERIZATION OF *PHYTOPHTHORA INFESTANS* POPULATION USING BIOLOGICAL MARKERS

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ABSTRACT: A survey was taken up during crop seasons of 2003-2004 and 2004-2005 in Baghpat, Muzaffarnagar, Meerut and Ghaziabad districts of western U.P for assessing late blight severity. In general, late blight severity was high during 2004-2005 in most of the localities and ranged from 4.3-81%. During 2003-2004, disease severity ranged from 2.5 to 68.8%. Ghaziabad and Baghpat districts were worst affected. A₂ mating type (old strain) was dominant in all the four districts. Most of the isolates collected from the four districts were metalaxyl sensitive. Race complexity of 7 and 8 genes were detected from Meerut while race complexity of 5, 8, 9; 7, 8; and 5, 7, 9 genes were recorded from Baghpat, Muzaffarnagar and Ghaziabad districts, respectively.

Several late blight resistant varieties have been introduced in the plains in the recent past. This might affect both the pace and direction of race development of *Phytophthora infestans*. A₂ mating type was first detected during mid 1990's in the plains (Singh and Shekhawat, 1999) and since then it has spread to new locations. Information on new mating type both in time and space is required for keeping a watch on pathways of disease epidemiology. Tolerance to metalaxyl was detected way back in Nilgiri hills (Arora *et al.*, 1992) and since then tolerant strains have been detected from other parts of the country also (Gupta *et al.*, 1999). In the present study, survey for the occurrence of late blight was conducted in four districts of western U.P. during the crop seasons of 2003-2004 and 2004-2005, and *P. infestans* isolates were collected and characterized using biological markers. In all, 13, 10, 10 and 9 villages from Meerut, Muzaffarnagar, Ghaziabad and Baghpat districts, respectively, were surveyed. Only those villages were selected where highly susceptible cv. Kufri Bahar was grown on large area. Survey was carried out twice during the crop season. Observations on disease severity were recorded using the scale developed by Henfling (1987). In each village, at least 10 fields were surveyed and in each field observations were recorded on 10 random sites of plot size approximately 3 m x 3 m. Two hundred twenty three *P. infestans* isolates were collected and analyzed for mating type, sensitivity to metalaxyl and physiological races.

During 2003-2004, late blight was first reported during the second week of December at Jat Munjhara village in Muzaffarnagar district, while during 2004-2005, it was first noticed in third week of December at Alipur village of Meerut district. In general, late blight severity was high during 2004-2005 and ranged from 4.3 to 81% whereas during 2003-2004, disease severity ranged from 2.5 to 68.8% in different districts. Ghaziabad and Baghpat districts were worst affected. Analysis for mating type revealed that the population of new strain (A₂ mating type) has been reduced considerably during the recent past (Table 1). Its frequency ranged from 0 (not detected) in Ghaziabad to 7.1% in Muzaffarnagar district. These results are at variance with the results obtained from temperate highlands of the country where new strain has completely displaced the old strain (Singh *et al.*, 2005).

Table 1. Mating type and metalaxyl sensitivity of *P. infestans* isolates collected from four districts of western U.P.

District	2003-2004					2004-2005					Mean				
	Mating type (%)		Metalaxyl sensitivity (%)			Mating type (%)		Metalaxyl sensitivity (%)			Mating type (%)		Metalaxyl sensitivity (%)		
	A1	A2	S	IR	R	A1	A2	S	IR	R	A1	A2	S	IR	R
Meerut	96.4	3.6	96.4	3.6	0	93.8	6.3	96.9	3.1	0	95.1	4.9	96.7	3.3	0
Baghpat	91.7	8.3	100	0	0	96.3	3.7	100	0	0	94.0	6	100	0	0
Muzaffarnagar	92.9	7.1	100	0	0	92.9	7.1	100	0	0	92.9	7.1	100	0	0
Ghaziabad	100	0	92.9	7.1	0	100	0	96.4	3.6	0	100	0	94.7	5.4	0

S= sensitive; IR= intermediate resistant; R= Resistant

It is likely that the weather conditions of subtropical plains characterized by high temperature and low humidity are not conducive for A₂ mating type. Most of the isolates collected were sensitive to metalaxyl. The intermediate level resistance (IR) was recorded to the tune of 5.4% in isolates collected from the district of Ghaziabad suggesting that metalaxyl-based compounds can still be used safely for the management of late blight. Race complexity of 7 and 8 genes were detected from Meerut; 5, 8 and 9 genes from Baghpat; 7 and 9 genes from Muzaffarnagar and 5, 7 and 9 genes from Ghaziabad districts during 2003-2004 (Table 2). In Baghpat district, 9-gene race was dominant while in Muzaffarnagar and Ghaziabad district, it was 7 gene races. During 2004-2005 also complex races of 7, 8 and 9 genes were detected from all the four districts.

Table 2. Racial structure of *P. infestans* in western U.P.

Race complexity	Race structure	Proportion (%) of isolates								Average (%)
		Meerut		Baghpat		Muzaffarnagar		Ghaziabad		
		2003-04	2004-05	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05	
5	1.3.4.7.11	0.0	0.0	20.8	0.0	0.0	0.0	10.7	0.0	3.9
7	1.3.4.6.7.10.11	17.9	15.6	0.0	22.2	17.9	14.3	14.3	14.3	14.6
7	1.2.3.4.7.10.11	17.9	18.8	0.0	0.0	25.0	17.9	21.4	17.9	14.9
7	1.2.3.4.5.6.10	0.0	0.0	0.0	0.0	17.9	21.4	17.9	21.4	9.8
7	1.2.3.4.5.7.10	0.0	0.0	0.0	14.8	14.3	14.3	0.0	14.3	7.2
8	1.2.3.4.6.7.10.11	14.3	21.9	16.7	22.2	25.0	0.0	0.0	0.0	12.5
8	1.3.4.6.7.8.10.11	25.0	0.0	0.0	18.5	0.0	0.0	0.0	0.0	5.4
8	1.2.3.4.5.9.10.11	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1
9	1.2.3.4.5.6.9.10.11	0.0	25.0	25.0	7.4	0.0	7.1	17.9	10.7	11.6
9	1.2.3.4.5.6.7.10.11	0.0	18.8	16.7	14.8	0.0	25.0	17.9	21.4	14.3
9	1.2.3.4.5.6.7.8.9	0.0	0.0	20.8	0.0	0.0	0.0	0.0	0.0	2.6

evident from the results that simple races have altogether been displaced by complex races which continue to dominate the race spectrum in the region.

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