

# Evaluation of potato genotypes against early blight (*Alternaria alternata*) of potato (*Solanum tuberosum* L.)



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## Summary

Early blight (*Alternaria alternata*) of the potato is the most destructive disease in tropical and sub-tropical countries. Natural epidemics of early blight are strongly influenced by environmental conditions, even though severe disease appears every year in northern India. Twenty-eight genotypes were used in this study to differentiate between early blight resistance and susceptible genotypes selected to represent a range of reactions when screened field conditions. Out of twenty-eight genotypes/varieties, six genotypes viz., CP-3021, 3153, Atlantic, Chip-3, Jx-161 and MS/78-62 showed a resistant reaction. While thirteen genotypes were moderately resistant. However, six genotypes were susceptible while three genotypes were highly susceptible. Resistant varieties can be the simplest, effective and economical method of plant disease control. The use of resistant varieties cannot only ensure protection against diseases but also save the time, energy and money spent on other control methods.

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**Keywords:** Early blight; genotypes; potato; *Alternaria*

## INTRODUCTION

The potato (*Solanum tuberosum*) is an important food crop in the world as well as in India and an important vegetable crop, belonging to the family Solanaceae. It was introduced in India by the Portuguese in the seventeenth century.<sup>2</sup> Potato is grown in more than 100 countries, under temperate, subtropical and tropical conditions. It is essentially a "cool weather crop", with the temperature being the main limiting factor on the production of tuber growth is sharply inhibited in temperatures below 10°C (50°F) and above 30°C (86°F), while optimum yields are obtained where mean daily temperatures are in the 18 to 20°C (64 to 68°F) range.<sup>5</sup> The intensive and extensive cultivation under the most favourable environmental conditions for potato crop production in the state failed to provide significant strides in potato yields, because of several production constraints, which may be due to the frequent occurrence of fungi, bacteria and viruses.<sup>10</sup> Disease control is a prerequisite for improving and maintaining the yield and quality of the potato crop and since the potato became widely grown serious outbreaks of disease and crop

failures and consequent social and economic effects have repeatedly provided incentives for improvement. Early blight is one of the most important foliar diseases of potatoes.<sup>4, 12, 13</sup> The early blight is first observed on the plants as small, black lesions mostly on the older foliage. Spots enlarge, and by the time they are one-fourth inch in diameter or larger and concentric rings in a bull's eye pattern can be seen in the centre of the diseased area. The tissue surrounding the spots may turn yellow. If high temperatures and humidity occur at this time, much of the foliage is killed. Lesions on the stems are similar to those on leaves, sometimes girdling the plant if they occur near the soil line.<sup>9</sup> Young plants are relatively resistant, but the susceptibility increases gradually and continuously from the initiation of tuber formation so mature plants are most susceptible to the disease.<sup>7</sup> Incidence of early blight has been observed in considerable form in potato-growing areas of South Eastern Rajasthan during the Rabi season.

## Materials and Methods

Potato genotypes were screened against the early blight disease under natural conditions. From each genotype, 10 plants were selected randomly and kept unsprayed throughout the season and tagged for the assessment of the disease. Twenty-eight genotypes as listed below were evaluated for their reaction to early blight disease of

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potato (Table 1 & 2). Disease rating was done on a 0-5 arbitrary scale.<sup>8</sup>

**Table 1: Description of the symptoms and disease reaction**

Category	Description of the symptoms	Reaction
0	Leaves free from infection	HR
1	Small irregular spots covering <5% of leaf area	R
2	Small irregular brown spots with concentric rings covering 5.1-10% leaf area	MR
3	Lesions enlarging, irregular brown with concentric rings covering 10.1-25% of leaf area	MS
4	Lesions coalesce to form irregular and appear as a typical blight symptom covering 25.1-50% leaf area	S
5	Lesions coalesce to form irregular and appear as a typical blight symptom covering >50% leaf area	HS

\*HR= highly resistant, R= resistant, MS= moderately susceptible, S= susceptible, HS= highly susceptible.

**Table 2: Name of genotypes/ varieties of potato**

S. No.	Name of genotypes/ varieties
1.	NJ-1501
2.	MP-97
3.	MP/94-322
4.	NJ-44
5.	NJ-85
6.	NJ-34
7.	MP-97-1606
8.	NJ-1530
9.	PS/RI-135
10.	CP-3021
11.	J-92-164
12.	JI-93-77
13.	MS/94-118
14.	JN-1177
15.	MS/92-2105
16.	J/93-4
17.	NJ-1
18.	MS/85-1663
19.	Kufri Sindhuri
20.	Kufri Bahar
21.	Kufri Pukhraj
22.	Kufri Khayati
23.	Kufri Pushkar
24.	3153
25.	Atlantic
26.	Chip- 3
27.	Jx-161
28.	Ms/78-62

The disease incidence was calculated by using the following formula:

$$\text{Percent disease incidence} = \frac{\text{Number of diseased leaves}}{\text{Total number of leaves examined}} \times 100$$

**Results and Discussion**

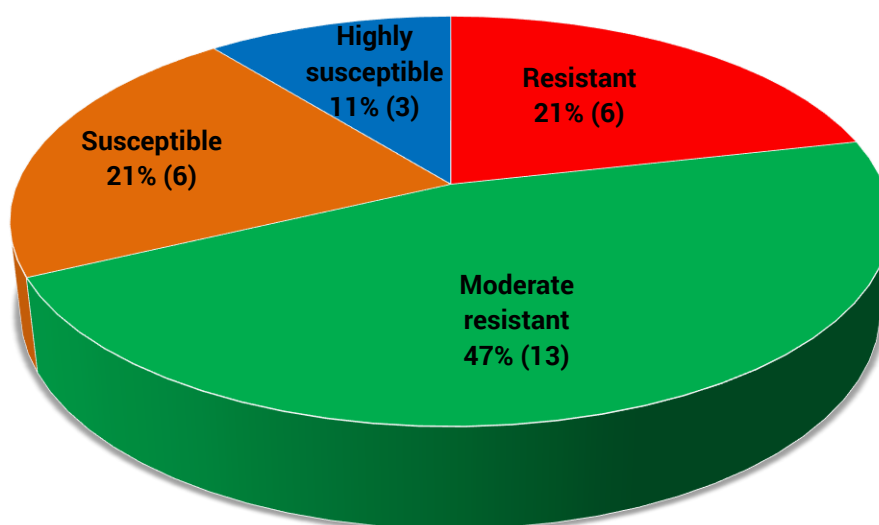
Twenty-eight genotypes/varieties of potato were screened for resistance to early blight under natural field conditions during *Rabi* 2019-20. The per cent germination, as well as per cent disease incidence, was calculated. The observation of early blight incidence was recorded at 60 and 75 days after sowing. The result in Tables 3 and 4 revealed that different varieties showed good germination percentages, which showed uniform growth of the plants (Fig. 1).

Out of twenty-eight genotypes/varieties, six genotypes viz., CP-3021, 3153, Atlantic, Chip-3, Jx-161 and MS/78-62 showed a resistant reaction, while thirteen genotypes i.e., NJ-1501, MP-97, NJ-44, NJ-34, MP-97-1606, PS/RI-135, JI-93-77, MS/94-118, JN-1177, Kufri Sindhuri, Kufri Pukhraj, Kufri Khayati and Kufri Pushkar were moderately resistant. However, six genotypes viz., NJ-85, NJ-1530, J-92-164, MS/92-2105, J/93-4 and Kufri Bahar were susceptible while, three genotypes i.e., MP/94-322, NJ-1 and MS/85-1663 were highly susceptible. The resistant genotypes are considered as the best method of plant disease management. Screened the twenty-eight potato genotypes/ varieties against the early blight of potato under natural conditions. Out of 28, observed the early blight incidence at 60 and 75 days after sowing. In the present study, six genotypes viz., CP-3021, 3153, Atlantic, Chip-3, Jx-161 and MS/78-62 showed a resistant reaction. Whereas, thirteen genotypes i.e., NJ-1501, MP-

97, NJ-44, NJ-34, MP-97-1606, PS/RI-135, JI-93-77, MS/94-118, JN-1177, Kufri Sindhuri, Kufri Pukhraj, Kufri Khayati and Kufri Pushkar were moderately resistant. Six genotypes viz., NJ-85, NJ-1530, J-92-164, MS/92-2105, J/93-4 and Kufri Bahar were susceptible and three genotypes i.e., MP/94-322, NJ-1 and MS/85-1663 were highly susceptible.

Less information regarding the screening of potato genotypes in the field against the early blight of potato has been generated. In the present study, varieties viz., Kufri Pukhraj, Kufri Khayati and Kufri Pushkar were found moderately resistant and Kufri Bahar as susceptible. A similar result was observed by Kumar *et al.* (2015);<sup>17</sup> they reported Kufri Pukhraj and Kufri Pushkar as moderately resistant, remaining Kufri Bahar and Kufri Sindhuri susceptible and Kufri Sutlej highly susceptible but, in our study, Kufri Sindhuri was found moderately resistant. Ganie and Ghani (2013)<sup>6</sup> also screened twenty-five potato genotypes for the early blight of potato under natural conditions. Out of twenty-five, one genotype SM/92-338 showed a tolerant reaction while three genotypes viz., Kufri Himan, SM/96-27 and SM/94-44 were moderately tolerant. Nine genotypes viz. Kufri Girdari, Kufri Shailaja, Kufri Chandramukhi, SM/98-239, SM/93-237, SM/90-45, HB/82-18, HB/50-45 and Shalimar potato-1 were moderately susceptible. Therefore, CP-3021, 3153, Atlantic, Chip-3, Jx-161 and MS/78-62 genotypes could be used for cultivation and breeding for resistance against the early blight of potato.<sup>3,7</sup>

**Result summary of genotypes**



**Fig. 1: Result summary of genotypes under field condition**

**Table 3: Result summary of genotypes**

Categories	No.	Genotypes/varieties
Resistant	6	CP-3021, 3153, Atlantic, Chip-3, Jx-161 and MS/78-62
Moderate resistant	13	NJ-1501, MP-97, NJ-44, NJ-34, MP-97-1606, PS/RI-135, JI-93-77, MS/94-118, JN-1177, Kufri Sindhuri, Kufri Pukhraj, Kufri Khayati and Kufri Pushkar
Susceptible	6	NJ-85, NJ-1530, J-92-164, MS/92-2105, J/93-4 and Kufri Bahar
Highly susceptible	3	MP/94-322, NJ-1 and MS/85-1663

**Table 4: Screening of different genotypes/varieties against early blight of potato**

S. No.	Name of genotypes /varieties	Germination (%)	Disease incidence (%)	
			At 60 DAS	At 75 DAS
1	NJ-1501	75	8	17
2	MP-97	66	6	15
3	MP/94-322	87	38	52
4	NJ-44	80	6	13
5	NJ-85	86	25	38
6	NJ-34	80	10	18
7	MP-97-1606	83	7	16
8	NJ-1530	70	24	37
9	PS/RI-135	92	5	14
10	CP-3021	85	2	4
11	J-92-164	82	26	39
12	JI-93-77	73	6	17
13	MS/94-118	68	5	14
14	JN-1177	65	7	16
15	MS/92-2105	90	25	36
16	J/93-4	80	27	39
17	NJ-1	76	40	54
18	MS/85-1663	80	39	55
19	Kufri Sindhuri	86	9	18
20	Kufri Bahar	88	29	38
21	Kufri Pukhraj	80	8	15
22	Kufri Khayati	70	5	13
23	Kufri Pushkar	73	5	12
24	3153	82	1	3
25	Atlantic	87	3	5
26	Chip-3	85	1	2
27	Jx-161	79	2	3
28	MS/78-62	90	2	4

## Conclusion

Out of twenty-eight genotypes/varieties, six genotypes viz., CP-3021, 3153, Atlantic, Chip-3, Jx-161 and MS/78-62 showed a resistant reaction. While thirteen genotypes were moderately resistant. However, six genotypes were susceptible while three genotypes were highly susceptible.

## Declaration of interests

The authors have no conflict of interest to declare.

## Data sharing

All relevant data are within the manuscript.

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