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Research Article

The Assessment of Early Blight Resistance in Different Variety of *Solanum tuberosum* and Biological Management of Early Blight

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ABSTRACT

The early blight is a common disease in Potato caused by *Alternaria* species. The present work focused on two aspects, first one is to evaluate the antagonistic effect of isolated bacterial and fungal species from potato fields of Depalpur, Sanwar and Indore tehsils of Indore district of Madhya Pradesh and other side we have screened the resistant variety against *Alternaria* species for selected potato fields of Indore district. Isolated Bacterial and fungal species were evaluated against *Alternaria* species by dual culture technique. Data was collected on radial growth and inhibition of growth. For the screening of the resistant variety against *Alternaria* species for selected potato fields of Indore district, field visits were conducted and evaluated the morphological observation time to time. We have found all studied species of *Trichoderma* retarded the growth of *A. solani* but *T. harzianum* most strongly suppressed the growth of *Alternaria solani* and in terms of bacterial species promising antagonists were reported as *Pseudomonas fluorescens*, *Bacillus subtilis*. The Percent disease index (PDI) caused by *Alternaria* species in Potato plants were evaluated in Kufri Chipsona-1, Kufri Chipsona-2, Kufri Jawahar, Kufri Surya in different villages of Indore districts, We reported high Percent disease index in Kufri Chipsona-1 and Kufri Surya followed by Kufri Chipsona-2 but it was recorded lower in Kufri Jawahar.

Keywords: *Solanum tuberosum*, Kufri Chipsona-1, Kufri Chipsona-2, Kufri Jawahar, Kufri Surya, Early blight resistance

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INTRODUCTION:

The *S. tuberosum* belonging to the Solanaceae family of the order Solanales is grown in more than 100 countries around the world. The favorable environmental condition for its production belongs to the temperate, sub-tropical and tropical zones. Mostly cultivated by planting tubers, the temperature range for its optimum growth lies between 18°C to 20°C (64°C to 68°C) ^{1&2}. Potatoes are a rich source of carbohydrates, vitamin C, some of the B vitamins, potassium with a low protein and fat content. They are an excellent supplier of energy rich diet. The antioxidant activity reported in potato is also quite good. The financial and nutritive deal with potatoes is very profitable ^{3 &4}. The antioxidants found in potatoes are glutathione, ascorbic acid, quercetin and chlorogenic acid. These are soluble in water and act as free radicals⁵. The “King of vegetables” is consumed by more than 1 billion people around the world because of its great nutritive value. All of the fungal diseases mentioned before are quite a disaster for growth and maturation of potato.



Figure 1: The early blight disease represent as rings in potato plant leaves.

However the disease which affects a plant at the end of growing period hampers the farmer's morale the most. One such disease is the Early Blight of Potato affecting them at the time when they are about to reach. It is a dangerous disease affecting the foliar parts of the plant i.e., the arial parts, mostly leaves⁶. Solanaceae family also known as the vegetable family gets affected by Early Blight drastically. Members such as potatoes and tomatoes are victims of fungus causing Early Blight⁷. Hence present investigation have been planned to investigate the microorganism which can be used as biological controller against *Alternaria* sp. from early blight affected region of Indore districts.

MATERIALS AND METHODS

In the present study for the assessment of Early Blight resistance in different variety of *Solanum tuberosum* and biological management of early blight, We have conducted this investigation in two part in first part we have collected soil samples from the rhizosphere and rhizoplane from the potato fields of Depalpur, Sanwar and Indore tehsils of Indore district of Madhya Pradesh during the sowing stage, the peak of vegetative growth and harvesting of potatoes. Bacteria and fungus were grown on nutrient agar and potato dextrose agar plates, pure culture were prepared and all the isolates were morphologically and molecularly identified for further the dual culture experiment at both level in vitro as we as in vivo.

For the Isolation and Identification of pathogen *Alternaria* species We have taken potato leaves with trait of early blight and brown spot lesions were detected, leaves were gathered. Leaves were gathered from above mentioned potato fields. The Leaves were kept in plastic bags, sealed, and relocated to a laboratory in Indore. For the isolation of *Alternaria* we have opted as previously described technique. Pathogenicity analysis was done by dual culture method.

In dual culture experiment the percent inhibition was calculated using the following formula:

$$PI = (R-r) \times 100/R$$

Where, PI = Percent inhibition

R = Radial growth of pathogen in control plate

r = Radial growth of the fungal colony opposite the bacterial colony isolates.

On the other hand in second part of present study, we have studied resistance against early blight in different varieties were grown by farmers of Indore district of MP.

The severities of disease were analyzed with help of 1 to 5 scales as follows:-

Estimation of Percent disease index (PDI)

$$PDI = \frac{\text{Sum of total ratings}}{\text{Number of plant examined} \times \text{Maximum class grade}}$$

Table 1: The severity of disease: The severity of disease was analyzed with help of 1 to 5 ale (Poysa and Tu, 1996) as follows:-

Class grade	Severity of disease
1	A symptomatic
2	1-10 % Disease infection
3	11-25 % Disease infection
4	26-50 % Disease infection
5	> 75 % Disease infection

RESULTS AND DISCUSSION

The biggest obstruction faced in potato cultivation and harvesting are threats from a wide range of pests and diseases hence in present investigation; Hence, We have planned to investigate the early blight disease of Potato of Districts of Indore division of Madhya Pradesh. Genus *Alternaria* is a big one and includes a number of species. The ones which are causing great financial loss are the pathogens *A. solani*, *A. alternate* and *A. brassicicola*. The life cycle of *Alternaria* consists of club-shaped conidia having septa in them. These conidia can occur singly or in chains varying from species to species. In present study we have reported some strains of *Alternaria* with of hyphal cells are dark in color, because of melanin and it contains spores within, safe and secure from harsh environment. This spore survives in soil for a very long period of time⁸. During the present investigation we have reported different bacterial and fungal species (table2)

Table 2: Isolation and characterization of fungi from rhizoplane and rhizosphere of Potato field.

S. No.	Samples collected	Penicillim spp.	Trichodea spp.	Aspergillus spp.	Alternaria spp.
1	rhizosphere	2	2	2	0
2	rhizoplane	0	1	0	0
3	Leaves	0	0	0	4
	Total	2	3	2	4

We also reported the reported the antagonistic effect of Bacterial species mainly belongs to *Bacillus* and *Pseudomonas* through pot experiments. On the other hand the antagonistic effect showed by isolated all the species of *Trichoderma*. *Trichoderma* separates were valued counter to test fungus by dual culture technique as described. We found all studied species of *Trichoderma* retarded (figure 2). The

results obtained through Dual Culture Experiments demonstrated *Trichoderma harzianum* in fungus and *Bacillus subtilis* in bacterial group⁹ showing highest antagonistic effect against *Alternaria solani*, Thus these two individual strains were selected for pot experiment and found both are suitable for biological control of early blight in potato.

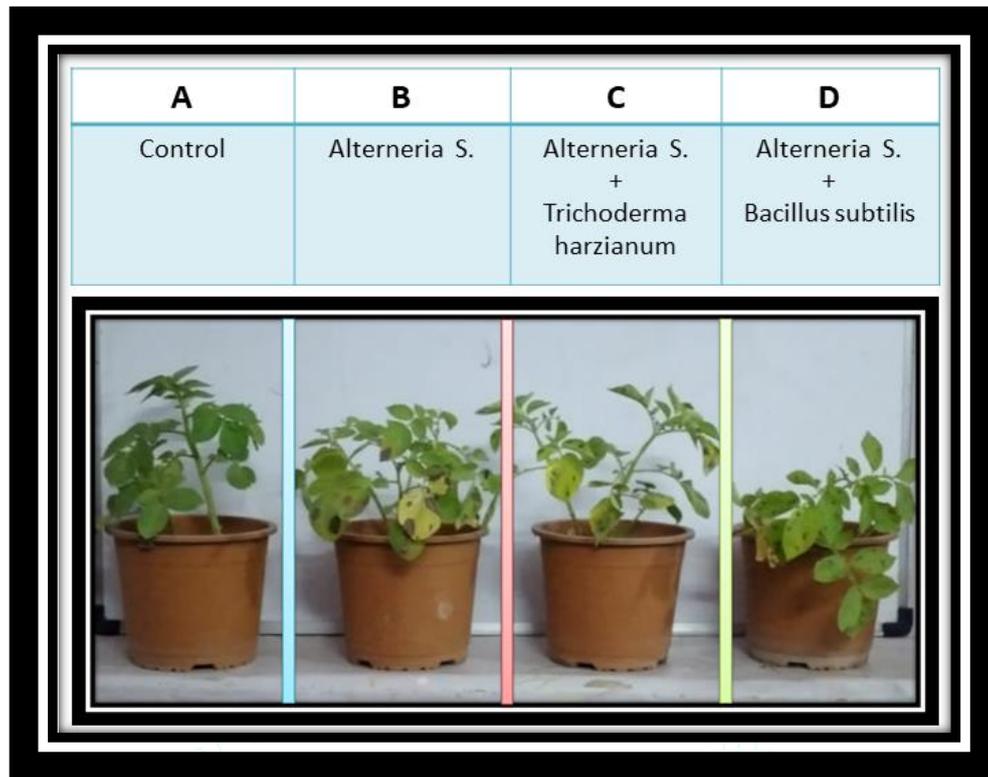


Figure 2: Figure showing Selected Pot experiments to screen biocontrol and plant growth promoting attribute of isolated microbes.

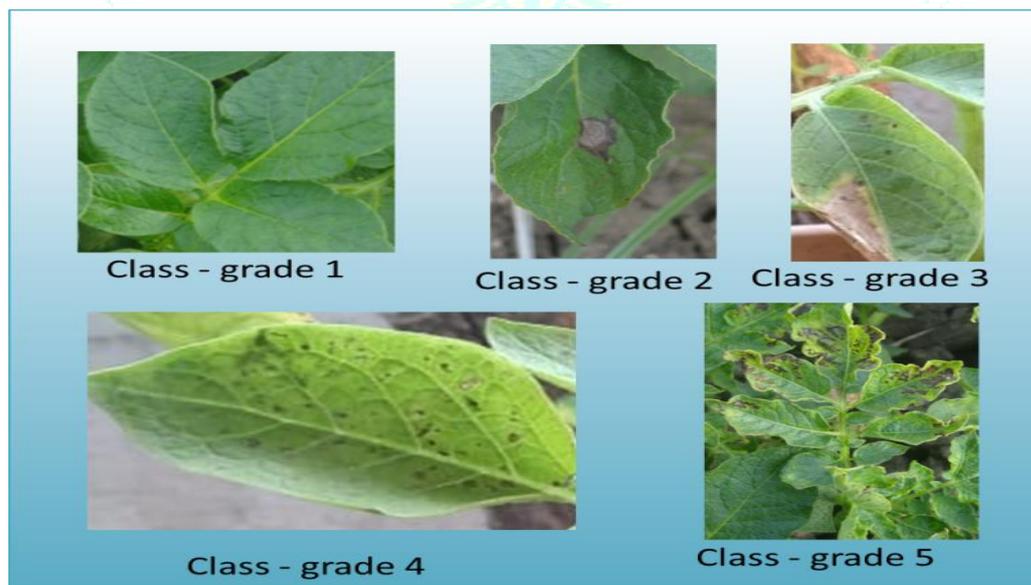


Figure 3: Different grading of disease on plant were found in present study, based on lower to high severity of early blight symptoms.

The different grading of severity (Figure 3) were reported in different varieties, which were grown by farmers of Indore districts. Different on the basis of their severity level different grading were prepared for the estimation of Percent disease index (PDI).

Percent disease index (PDI) caused by *Alternaria* species in Potato plants were evaluated in Kufri Chipsona-1, Kufri Chipsona-2, Kufri Jawahar, Kufri Surya in different villages of Indore districts. We reported high Percent disease index in Kufri Chipsona-1 and Kufri Surya followed by Kufri Chipsona-2 but it was recorded lower in Kufri Jawahar

Table 3: Percent disease index (PDI) caused by *Alternaria* species in Potato plant.

S. No.	Potato Variety	PDI			
		Depalpur Tehsil, Villages	Indore Tehsil, Villages	Sanwer Tehsil, Villages	Mean Value
1	Kufri Chipsona-1	25.56	29.82	27.33	27.57
2	Kufri Chipsona-2	24.83	24.54	28.36	25.91
3	Kufri Jawahar	18.68	21.46	22.46	20.87
4	Kufri Surya	25.26	27.32	26.37	26.32

CONCLUSION

Overall, this study has shown that antagonistic indigenous soil bacteria can give an alternative to the indiscriminate use of pesticide in potato agro-systems. The promising antagonists were reported as *Pseudomonas fluorescens*, *Bacillus subtilis*. On the other hand, the antagonistic effect of all isolated fungi species of *Trichoderma*, *T. Herzianum* most suppressed the development of *Alternaria salani*. On the basis of the Percent disease index (PDI) based on field observation, Present study would recommend KufriJawahar variety for farmers for potato crop cultivation in Indore District of Madhya Pradesh and Farmers should spray of aforementioned antagonistic microorganism against *Alternaria salani* for the protection of potato crop from early blight.

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