*Mycopath* (2014) 12(1): 63-67 **Brief Article**

# Evaluation of different antagonistic fungi against common scab of potato

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## Abstract

In Pakistan, potato is among the main cash crops for the farmers. Common scab (*Streptomyces scabies*) reduced the quality and market value of potato tubers and environmental hazardous chemicals are used for the control of this disease. In this study, three antagonistic fungi were evaluated for their biological management potential of common scab and maximum inhibition was observed by *Trichoderma harzianum* followed by *Penicillium digitatum* and *Aspergillus flavus*. Disease incidence, yield and disease severity was determined and Randomized Complete Block Design was used for the statistical analysis. This applied work will enhance the seedling growth and biological management will reduce the cost of environmental hazardous chemicals.

**Keyword:** Potato, Common Scab, Biological Management

## Introduction

Edible potato (*Solanum tuberosum* L.) is the world's leading vegetable crop along with staple food and is placed at fourth position after rice, wheat and maize (Rauscher *et al.,* 2006). It has two compensations over the other crops i.e. its production and calories per unit area are higher than wheat, maize and rice while in term of total production potato provides 12-15 times more yield per hectare as compared with cereals. Potato tubers are excellent source of carbohydrates, protein, and vitamins. Potatoes are widely cultivated, and could contribute in reducing worldwide food shortages. Soil and climatic conditions prevalent in Pakistan are highly conducive for the production of three crops of potato a year, i.e. autumn and spring crops in the plain and summer crop in the hills (Zanoni, 1991). In Pakistan, potato is cultivated over an area of 127.7 thousand hectares and annual production is 3726.5 thousand tons which is very low as compared to other potato growing countries (GOP, 2011). While bacteria, nematode (Gondal *et al*., 2012), fungus (Ashraf *et al*., 2012; Mehboob *et al*., 2013) and viruses (Abbas *et al*., 2013; Nosheen *et al*., 2013; Abbas *et al*., 2012; Abbas and Hameed, 2012) along with a biotic factors play a pivotal role for yield reduction in potato crop of Pakistan.

Common scab disease is most prevalent in neutral or slightly alkaline soil throughout the potato-cultivating regions of the world (Bouchek-Mechiche *et al*., 2000). The tuber yield is not much effective by this disease but it reduced the quality and market value of potato tubers (Liu *et al*., 1996). Different species of *Streptomyces* are responsible for the common scab (Healy *et al*., 2000) and among these species. *Streptomyces scabiei* is the most significant pathogen of potato crops (Keinath and Loria, 1989). It enters tissue through lenticels, wound or young tubers and causing scab disease by producing cyclic dipeptides, thaxtomins (Lawrence *et al*., 1990). Soil treatment with

Pentachloronitrobenzene (Potter *et al*., 1958), potato seeds tubers treated with maneb-zinc dust (Agrios, 1997), regulating the pH of the soil (Doyle and Maclean, 1960) and irrigation (Loria *et al*., 1997) are the most effective tools for the control of this disease. Agrichemicals affect the quality of crop and environment, so studies on environment and plant friendly alternative controls measure are necessary (Neeno-Eckwall *et al*., 2001).

Control of soil born pathogen by antibiotic producing micro-organisms is now considered a viable and environmental friendly disease control technology (Munimbazi and Bullerman, 1998). Derived from microorganisms, validamycin (Iwasa *et al*., 1971) and kasugamycin (Tominaga and Kobayashi, 1978) are widely used agricultural antibiotics. In the case of common scab disease, it has also been reported that *S. scabiei* can be inhibited by an antibiotic isolated from *Streptomyces diastatochromogenes* strain PonSSII, although the structure of this antibiotic has not been distinctly characterized (Eckwall and Schottel, 1997). In this study, *Aspergillus flavus, Penicillium digitatum and Trichoderma harzianum* were used as antagonist fungi against

common scab of potato and the yield and disease severity was recorded.

## Materials and Methods

The potato tubers exhibited the typical symptoms (50% surface area) of common scabs were collected from Ayub Agricultural Research Institute (AARI), Faisalabad. The suspected tubers were then transferred into autoclave polythene bangs and labelled properly. The pure culture of antagonistic fungi (*A. flavus*, *P. digitatum* and *T. harzianum*) was obtained from Plant Pathology section of AARI, Faisalabad and further multiplied on artificial media (potato starch 20 g, agar 20 g, dextrose 20 g and distilled water 1000 mL). Morphological characters were used for the authentication of antagonistic fungi as described keys provided by Booth (1971), Nelson *et al.* (1983) and Barnett and Hunter (1990). The slurry was prepared by shaking the antagonistic fungi in distilled water and dipping of suspected tubers. The tubers treated with each of the antagonistic fungus were sown in row with three replications and the 4$^{th}$ treatment was sown without any treatment. All cultural practices (cultivation, nutrition and pests control) were carried as required out and pesticides were used to control insect pest. The yield (kg) was recorded and tubers were rated on the scale of 1 to 6 (Table 1) based on percentage of tubers surface covered with scab lesion (Ahmed *et al*., 1991).

**Table 1.** Scale of common scab of potato (Ahmed *et al*., 1991).

| | |
|---|---|
| 1 | 0% |
| 2 | 1% or less |
| 3 | 1-10 |
| 4 | 11-20% |
| 5 | 21-50% |
| 6 | 50% or above |

Randomized Complete Block Design (RCBD) was used for statistical analysis and diseased incidence was recorded by the following formula

$$\text{Percentage Disease Incidence (DI)} = \frac{\text{Infected Area}}{\text{Total Area}} \times 100$$

## Results and Discussion

*Streptomyces* species are usually introduced into potato fields by means of infected tubers and the presence of the pathogen was found in previously infected field even in the absence of host (Bouchek-Mechiche *et al*., 2000). In this study, three antagonistic were used for the control of *S. scabies*. The tubers treated with *T. harzianum* exhibited the maximum yield (1909.0 g) followed by due to *A. flavus* (1655.7 g) and *P. digitatum* (1504.0 g). *A. flavus* and *P. digitatum* were statistically similar in respect to their effectiveness but are different significantly as compared to the control (Table 2). Inoculation of *T. harzianum* resulted in lowest disease incidence 29.46% as compared to *A. flavus* (51.66%) and *P.digitatum* (60.60%) and maximum disease incidence was observed in positive control (Table 2). According to the disease assessment key, each tuber was divided into different levels and first level of disease was 1% or less area of tuber covered with the disease. At first (1% or less) and second (1-10%) level, control exhibiting maximum disease severity while *T. harzianum* inoculation resulted in maximum reduction of disease severity and all treatments were differ statistically. At third level (11-20%), *A. flavus* and control showed similar results and did not differ significantly. At second last (21-50%) and last level (51% or above), all the treatment are statistically similar but significantly different from control and *A. flavus* was less effective as compared to other treatments (Table 2).

Present findings are in line with previous results of many results that *Trichoderma* strains produced different enzymes (chitinase, protease and cellulose) and these enzymes have been involved in the antagonistic activity and also increased the growth of seedling. Besides, the efficiency of the bio control agent could further be improved when it was applied with the low concentration of recommended fungicide (Silimela and Korsten, 2001).

Presently there is no single control measure that can prevent a serious outbreak of common scab. Use of antagonistic fungi along with weeds control may play a pivotal role in reducing yield losses in potato crop of Pakistan.

**Table 2**: Effect of different antagonistic fungi on yield, disease incidence and disease severity.

| **Treatments** | **Yield (g)** | **DI (%)** | **Disease severity (%)** | | | | |
|---|---|---|---|---|---|---|---|
| | | | >1 | 1-10 | 11-20 | 21-50 | >50 |
| Control | 1319 c | 75.63 a | 4.00 a | 4.00 a | 5.00 a | 3.33 a | 3.66 a |
| *Trichoderma harzianum* | 1909 a | 29.46 d | 1.00 d | 1.00 d | 1.33 b | 2.00 b | 2.66 b |
| *Penicillium digitatum* | 1504 bc | 60.60 b | 1.66 c | 1.66 c | 2.33 b | 2.33 ab | 2.66 b |
| *Aspergillus flavus* | 1655 b | 51.66 c | 3.00b | 3.50 b | 2.66 a | 2.64ab | 3.07b |

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