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Effect of plant extracts on early blight of potato (*Solanum tuberosum* L.)

Salpa Debbarma, Sunil Zacharia and Sobita Simon

Abstract

Early blight is one of the most common and distressing disease of potato plant which is caused by fungus, *Alternaria solani*. The antifungal activity of five plant extracts namely *Azadirachta indica*, *Allium sativum*, *Lantana camera*, *Ocimum sanctum*, and *Eucalyptus globolus* at 5% concentration and mancozeb 0.2% concentration as a treated check, was tested for management of *Alternaria solani* *in vivo*. In field experiments, the highest reduction of disease severity was achieved by applying the extracts of *Eucalyptus globolus* and *Ocimum sanctum*, at 5% concentration (20.83 and 25.37) as compared to mancozeb (treated check) at 0.2% concentration (14.79), and T₀-Control(treated check) (44.32). All treatments significantly reduced the early blight disease severity as well as increased the plant height and yield of potato compared to the infected control under field conditions.

Keywords: Potato, Early blight, *Alternaria solani*, Plant extracts.

Introduction

Potato (*Solanum tuberosum* L.) is the fourth most important world crop (Spooner and Bamberg, 1994)^[10]. Potato is considered 'The King' in food staples and hardly any domestic kitchen is available which does not use it in one or the other form as it possesses all the attributes to be a potential food crop. Potato is the only non-cereal food crop to commend such a high position in the world since being nutritious; it can solve the problem of malnutrition and under nutrition if adopted as a major food crop. It has been recognized as a whole some food and richest source of energy in most countries of the world where it forms important part of the human diet. Potato contains significant levels of phenolic compounds and vitamin C as potent antioxidants (Brown, 2005)^[3], which inactivate reactive oxygen species, reduce oxidative damage, lead to improved immune functions and reduces risk of cardiovascular diseases, cancer, cataract, diabetes and aging.

Early blight is one of the most important disease which is caused by the fungus *Alternaria solani* (Ellis and Martin). Jones and Grout, that occurs in most potato growing regions world-wide (Vanderwalls *et al.* 2001)^[11].

Early blight may also cause dry rot of tubers, reducing both the quantity and quality of marketable tubers (Nnodu *et al.*, 1982)^[6]. Environmental factors such as temperature, wetness duration and relative humidity (moisture) affect the development of early blight on potatoes. Water in the form of high relative humidity, rainfall or dew accumulation can increase conidia germination and pathogen infection. Alternating low and high humidity conditions have also been shown to favor disease development (Vanderwalls *et al.*, 2001)^[11]. Early blight is also enhanced through continuous potato production.

Materials and Methods

The present investigation was carried out at the Field Experimentation Centre, Department of Plant Pathology, SHUATS, Allahabad (U.P.) during Rabi-(2016-2017). The soil of the experimental field was sandy loam with pH 5.6. The experiment was conducted in Randomized Block Design with 7 treatments. The treatments were replicated three times. Treatments were randomly arranged in each replication divided into 21 plots. The cash plot size was 2 x 1.5m. The recommended agronomical practice was followed to raise the crop healthy. Foliar spray of chemical and botanicals were started at onset of the disease and repeated Mancozeb @ (0.2%), *Eucalyptus globolus* (5%), *Ocimum sanctum* (5%), *Lantana camara* (5%), *Allium sativum* (5%), *Azadirachta indica* (5%) and control were used for management of disease.

Isolation of the pathogen

Leaves were collected from infected potato plants bearing characteristic symptoms of early blight. These leaves symptoms after mounting on slide were examined under microscope to confirm the presence of *Alternaria sp.*

The infected leaf parts were cut into small pieces of two to three mm dimension in a manner so that pieces had some green portion also. Such leaf bits was surface sterilized with 0.1 per cent mercuric chloride (HgCl₂) solution for 30 seconds and washed three times with sterile distilled water to remove any traces of mercuric chloride adhered with leaf bits. 2-3 leaf bits were transferred on PDA medium contained in sterilized petriplates with the help of forceps. These petriplates were incubated at 25°C ± 2°C, after 3 days mycelia growth was observed around leaf bits. With the help of cork borer from this colony growth a portion from the periphery having single hyphal tip was separated and transferred to other petriplates having medium to get pure culture and identification of the pathogen were confirmed by observing the morphological features of colony, spore characteristics and referring the relevant literature.

Preparation of botanicals

For preparation of extracts 50gm. leaves were taken in a clean blender and blended without water, the pulverized leaves tissue were filtered through three fold of muslin cloth and 100% pure filtrate was used as an extracts in the ratio of 1:1(W/V) of seed and solution.

Results and Discussions

The present study entitled "Effect of plant extracts on early blight of potato (*Solanum tuberosum* L.)" was conducted in the Department of Plant Pathology, SHUATS, during 2015-2017. The perusal Table 1 and figure 1 depicts that significantly (P < 0.05) average lower diseases intensity was

recorded in foliar sprays of *Eucalyptus globolus* (5.0%) 20.83 % with yield (3.57) kg/ha, as par compared with mancozeb (0.2%) 14.73% with yield (4.67 kg/ha) (treated check) followed by *Ocimum sanctum* (5%) 25.37% and yield (3.30 kg/ha), *Allium sativum* (5%) 29.03% and yield (2.33 kg/ha), *Lantana camara* (5%) 30.35% and yield (2.73 kg/ha), *Azadirachta indica* (5%) 32.11 per cent and yield (3.15kg/ha), where as depicted by control 44.32 per cent and yield (1.50 kg/ha) the result of present study are in accordance to the finding of Rasool *et al.*, (2011). All the treatment combination was showed significant different to over control. Height of plants(cm) reveals that the maximum height of plants of Potato was observed in *Eucalyptus globolus* treatment (19.43 cm) as compared to mancozeb (20.21 cm)(treated check), followed by, *Ocimum sanctum*(18.81 cm), *Allium sativum*(18.59 cm) and *Lantana camara* (18.13 cm) whereas the minimum hight of plant was showed by *Azadirachta indica* (17.87cm). Whereas the all treatment combinations was showed significantly different to over control. Similar finding reported by Abed *et al.* (2013)^[1].

Table 1

Sl. No.	Treatments	Plant height	Disease intensity	Yield (kg/ha)
T ₀	Control (Untreated check)	16.70	44.32	1.50
T ₁	<i>Azadirachta indica</i>	17.87	32.11	3.15
T ₂	<i>Allium sativum</i>	18.59	29.03	2.33
T ₃	<i>Lantana camera</i>	18.13	30.35	2.73
T ₄	<i>Ocimum sanctum</i>	18.81	25.37	3.30
T ₅	<i>Eucalyptus globolus</i>	19.43	20.83	3.57
T ₆	Mancozeb (Treated check)	19.63	14.79	4.67
	S.E.D.	12.48	23.57	0.581
	C.D. (P = 0.05%)	25.49	48.14	1.162

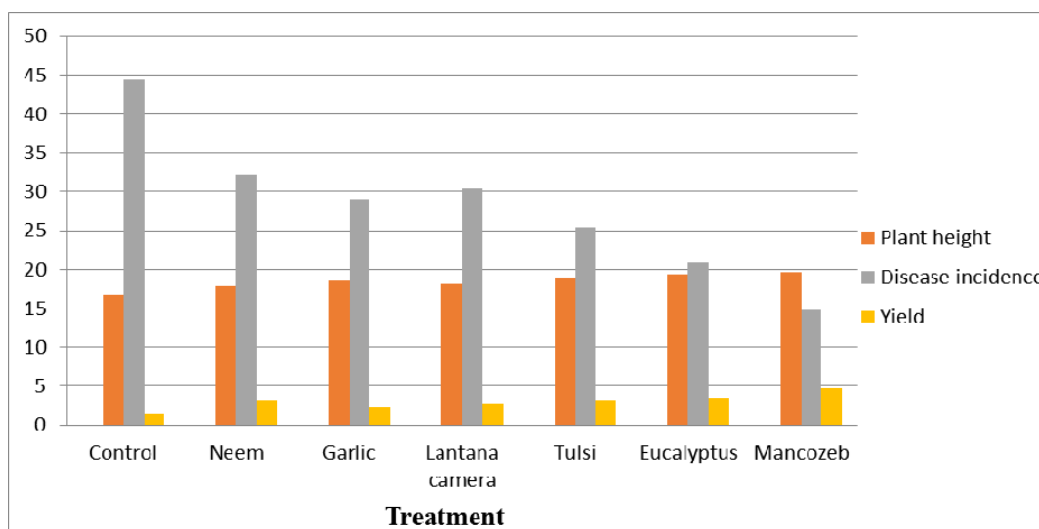


Fig 1

Conclusion

The present study concluded that effect of Eucalyptus leaf extracts (fs) as compared with mancozeb (fs) (treated check) was significantly reduced disease incidence of *Alternaria solani* early blight of potato. From the above study we can conclude that the botanicals can be used as an alternative of fungicides in future and can be employed for sustainable Agriculture, but it still needs more investigation to be conducted in this regard for valid recommendation.

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