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EFFECT OF JATROPA LEAF POWDER AMENDMENT AGAINST LEAF SPOT *(Alternaria solani)* on *Lycopersicum esculentum* L.

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ABSTRACT

Experiment was conducted in the Department of Plant Protection, SHIATS to evaluate the efficacy of *Jatropa* leaf powder at concentration 1, 2 and 3 % w/w against *Alternaria solani inciting* the leaf blight of tomato. Pathogen was isolated from the research field of SHIATS and cultured on Potato Dextrose Agar medium. Mass culture of pathogen was carried out in Sorghum grains and soil was sickened it with the mass culture of pathogen @ 40g (4×10^3/g of soil). The *Jatropa* leaf powder (*JLP*) was amended in sickened soil (100g/pot) before 2 days of seed sowing. The tomato seeds were sown in 4 treatments and 5 replications in the fiber cup including control. The symptoms started as yellowing and browning of leaves after 15 days of germination and the symptoms progressed upwards with the growth of plants. Disease incidence and Percentage Disease intensity was checked at regular intervals in 15, 30 and 45 days after germination. The results showed that *JLP* at all concentration was found to be effective in suppressing the disease intensity. However, 3 % concentration was found to be significantly superior in controlling of disease as well as favoured the growth of tomato plant over other treatments including control.

Keywords: *Alternaria solani*, *Jatropa* leaf powder, leaf blight, tomato.

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill) has become the most popular vegetables around the world. It is used in many ways such as cooked, salad, soup, preserves, pickles, ketchups, sauces and many other products and is served as baked, fried and sauce on various foods. According to Chatfield (1954) 100 g edible portion of tomato contains 94.1 g water, 1.0 g protein, 0.3 g fat, 4.0 g carbohydrate, 0.6 g fiber, Vitamin A 1100 I .U., Vitamin B 0.20 mg, nicotinic acid 0.6 mg, pantothenic acid 0.31 mg, Vitamin C 23 mg, Vitamin E 0.27 mg, Biotin 0.004 mg, malic acid 150 mg, citric acid 390 mg, oxalic acid 3.5 mg, sodium 3 mg, potassium 268 mg, copper 0.10 mg, manganese 0.19 mg, phosphorous 27 mg, sulphur 11mg and chlorine 51 mg. It stimulates tropid liver and is very useful in chronic dyspepsia. According to Nadkarni (1927) it has good medicinal values; the pulp and juice of fruit are digestible and act as mild aperients, a promoter of gastric secretion and a blood purifier. It is considered to be an intestinal antiseptic as it has a cleaning effect in the portion of alimentary canal. It is very clear that it has high nutritive value, therefore it is sometimes called as "poor man's orange" (Singh *et al*., 2004). But this very important crop gets damaged by different types of pest and diseases that can cause high economic losses to the growers.

Early blight caused by A. solani is the most destructive disease of tomatoes in the tropical and subtropical regions. Each 1% increase in intensity can reduce yield by 1.36%, and complete crop failure can occur when the disease is most severe (Pandey, K.K., *et al*, 2003). Yield losses of up to 79% have been reported in the U.S., of which 20-40% is due to seedling losses (i.e., collar rot) in the field (Chaerani, R. and R.E Voorrips, 2006). Best estimates suggest that total annual global expenditures on fungicide for control of A. solani is approximately $32millionfor tomatoes (http://en.wikipedia.org/wiki/Alternaria_solani).

However the overzealous and indiscriminate use of most of the synthetic fungicides has created different type of environmental and toxicological problems. Recently, in different parts of the world, attention has been paid towards exploitation of higher plant products as novel chemotherapeutants in plant protection. The popularity of botanical pesticides is once again increasing and some plant products are being used globally as green pesticides (Gurjar *et al*., 2012).

The Purpose of this study is to find the efficacy of the *Jatropa* leaf powder against *Alternaria solani* causing leaf spot of the tomato.

MATERIALS AND METHODS

Test botanical

Jatropha curcas L. is a species of flowering plant in the family, Euphorbiaceae, and is an important plant as it is used to extract bio-diesel and it possesses antimicrobial activity. The plant, *J. curcas* is a small tree or large shrub which can reach a height of up to five meters. The genus *Jatropa* is reorganized as an important source of numerous structural classes of secondary metabolites, including alkaloids, diterpenes, lignans, triterpenes and cyclic peptides .Many attempts have been made to determine the efficacy of *Jatropa* against medical diseases as well as plant diseases (http://en.wikipedia.org/wiki/Jatropha_curcas).

Collection of plant material

Leaves of *Jatropa curcas* were collected from the surrounding area of the SHIATS, campus, Allahabad.

Surface sterilized with 0.1% NaOCl was done to remove microbes present in it and washed two to three times with sterile distilled water, dried in an oven at 50-60°C for 48 hours. Fine powders of these plant leaves were prepared and preserved separately in polythene bags at room temperature (28 ± 2°C) for 48 hours. (Mehrotra R.S. and Aggarwal Ashok. 2003).

Isolation of test fungi

The test fungus namely *Alternaria solani*, was isolated from diseased leaves of tomato for this the affected parts of the host were brought to the laboratory in polythene bags. They were cut into small pieces; surface sterilized with 0.1 per cent sodium hypochlorite solution and passed through three changes of sterile distilled water. The affected bits were placed aseptically on Potato Dextrose Agar slant. The fungal growth from the affected bits was picked up and transferred on sterilized petriplates for mass multiplication. The fungus identification was confirmed using manual of fungi maintained on PDA slants (Mehrotra R.S and Aggarwal Ashok. 2003).

***Alternaria solani*, Deuteromycetes, and Form Family-Dematiaeae**

Alternaria solani causes diseases of several crop plants of family solanaceae. The early symptoms are in the form of small spots on the leaves which later on enlarge to form concentric rings. The fungus also infects fruits and tubers in severe condition (http://en.wikipedia.org/wiki/Alternaria_solani)

Amendment of sickened soil

Each fibre pot containing 100 gram soil was sickened with the mass culture of pathogen @ 40g (4×10^3/g of soil). The *Jatropa* leaf powder was amended in sickened soil (100g/pot) before 2 days of seed sowing in four different treatments including control. The treatments are 1% (1g leaf powder in 100 g fiber cup filled with sickened soil), 2% (2 g leaf powder in 100 g fiber cup filled with sickened soil) and 3 % (3 g leaf powder in 100g fiber cup filled with sickened soil). The tomato seeds were sown in 4 treatments and 5 replications in the fiber pot. Each pot was sowed with six seeds. Germination percentage, Disease intensity, root length, shoot length, root weight, shoot weight were measured for the study.

Evaluation of effect of the JLP powder on supressing disease and on enhancing the growth of tomato plant

In order to evaluate the efficacy of *Jatropha* leaf powder against the leaf blight of tomato, germination percentage was calculated after the emergence of the seedlings. Diseases incidence and Percentage disease intensity were also calculated at regular interval of 15, 30 and 45 days. The root length and shoot length as well as root weight and shoot weight were also taken. The amount of disease is generally referred to as disease intensity (Teng, 1983). The germination percentage, disease incidence and percentage disease intensity based on the population size of a sample (sample size neither less than ten nor more than fifty of any size of population studied) were estimated by the following formulae:

$$\text{Germination percentage} = \frac{\text{total no of seedlings emergence}}{\text{total no of seeds sown}} \times 100.$$

$$\text{Disease incidence (I)} = \frac{\text{sample plants affected}}{\text{total samples}} \times 100.$$

$$\text{Disease intensity} = \frac{\text{sum of all ratings}}{\text{no of observation xhighest ratings}} \times 100 \text{ (PDI=McKinney's Index)}$$

For visual estimation of severity, 0 - 9 point scale (No infection - 0); 0 -10% leaf area infected - 1; 10 - 20% leaf area infected - 2; 20 - 30% leaf area infected - 3; 30 - 40% leaf area infected - 4; 40 - 50% leaf area infected - 5; 50 - 60% leaf area infected - 6; 60 - 70% leaf area infected - 7; 70 - 80% leaf area infected - 8; 80 - 90% or more leaf area infected - 9) were used for rating of all foliar diseases studied. In the case of die back of rose, a whole plant is considered a unit of infection.
(Gosh P.P. *et al*., 2009)

The data was recorded and subjected to statistical analysis and conclusions were drawn on the basis of analysis of variance. The calculated value of F was compared with the tabulated values at 5% level of significance for an appropriate degree of freedom (Tapwal Ashwani *et al*., 2011)

RESULTS

It is evident from results presented in Table-1 that almost all the treatments were found to be supportive or stimulatory for seedling emergence, shoot and root length of the test seeds in more or less degree. Maximum seedling emergence was recorded at the concentration of 2 and 3% extract (95%) followed by (80%) at 1% extract and (50%) in control. Maximum root and shoot lengths were recorded at the 3% and 2% concentration followed by 1% concentration. Similarly root weight and shoot weight exhibit highest at the concentration of 3% followed by 2% and 1%. The root length, shoot length, root weight and shoot weight is highly retarded in control with respect to treatments.

Table-1. Physical behaviours of seedlings (30 days old).

Treatment	Seedling emergence (%)	Plant height (cm)	Root length (cm)	Root weight (mg)	Shoot weight (mg)
control	50	10	14	0.11	0.36
JLP (1%)	80	16	16	0.78	2.35
JLP (2%)	95	21	20	1.79	3.46
JLP (3%)	95	29	22	2.88	4.21

It is evident from Table-2 that the disease incidence (DI) and percentage disease intensity (PDI) were found decreasing as the concentration increases compared to control. However, the efficacy was found non-significant among the concentration of *Jatropha* leaf powder Table-2.

Table-2. Disease intensity (DI) and percentage disease intensity (PDI recorded on treatments and control on 30 days old seedlings.

Treatment	D.I mean	PDI Mean
Control	48.0 [a]	37.7 [a]
JLP (1%)	28.64 [b]	17.2 [b]
JLP (2%)	25.57 [b]	15.6 [b]
JLP (3%)	25.25 [b]	15.5 [b]
Grand mean	31.7	21.5
C V (%)	30.9	44.7
S e(d)	6.93	6.80
LSD (5%)	15.67*	15.37*

*Significant at $p < 0.05$ level of significance

From above results we can concluded that the leaf of *Jatropa* Comprises the biological compounds that is found to be beneficial in checking the growth of the diseases (Figures 1, 2 and 3) as well as favoured the growth of the plant (Figure-4).

More than 800 million people in the developing countries do not have adequate food supplies and at least 10% of food is lost due to plant diseases (Strange and Scott, 2005). Many of the earlier pesticides were the extracts of plants, and several plants have been exploited more widely as sources of commercial insecticides. But, from 1940s, synthetic agrochemicals largely replaced the plant-derived products as the key commercial pesticides. Research on plant-derived natural products for the use in agriculture went into decline for a number of years. But this trend is now reversed as it becomes evident that plant natural products still have enormous potential to inspire and influence the modern agrochemical research (Choi *et al*., 2004).So more researches should be carried out in finding the pesticidal activity of the botanicals which can be very fruitful in term of cost, ecology and availability especially to the poor farmers.

Plates

In vivo efficacy testing of *Jatropa* leaf extract against leaf spot of tomato (*Alternaria solani*).

Figure-1. Development of *Alternaria* leaf spot in 15 days old seedlings in control.

Figure-2. Effect of Jatropha leaf extract on seedling performance of tomato (from left to right T3, T2, T1 and control).

Figure-3. Development of disease in control. but healthy in T3.

Figure-4. Growth of plant highly retarded in the control but significant growth in treatments.

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