



EFFICACY OF *Eucalyptus* ESSENTIAL OIL AGAINST LEAF SPOT (*Alternaria solani*) of *Solanum melongena* L.

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ABSTRACT

With a view to explore the efficacy of *Eucalyptus* essential oil against leaf spot (*Alternaria solani*) of *Solanum melongena* L., an experiment was conducted in the poly house at Department of Plant Protection SHIATS, Allahabad. Essential oil of *Eucalyptus* at different concentrations was evaluated against *Alternaria solani* causing leaf spot of Brinjal. Pathogen was isolated, identified and mass cultured and was artificially inoculated in the soil @40g (8×10^3 /g of soil). The Brinjal seeds were soaked in *Eucalyptus* oil at 4 different concentration @1, 2, 3 and 4 % for an hour before 24 hours of sowing and then treated seeds were sown in small fiber cups (100g/cup) in 5 treatments and 6 replication including control. Diseases manifests on 30days old seedling under control characterized by blight, small, circular, brown necrotic leaf spot with a chlorotic halo, which gradually enlarged and coalesced causing withering and shedding of the leaves while in others found less. The results revealed that at 1% and 2% concentration of *Eucalyptus* oil favoured the growth of plants which were healthy suggesting inhibitory effect of essential oil against disease symptom. However at higher concentration of 3 and 4% essential oil of *Eucalyptus* it becomes toxic to the growth of plants since plants shows yellowing and stunted growth.

Keywords: *Alternaria solani*, Brinjal, *Eucalyptus* oil, inhibitory effect.

INTRODUCTION

Brinjal (*Solanum melongena* L.) is one of the most common vegetable grown throughout the country for its purple, green and pendulous fruit (www.celkai.in/Crops/Vegetables/Brinjal/brinjal.aspx). Total production of Brinjal is about 32 million tonnes in the world wherein India is world's second largest producer after China (Choudhary and Gaur, 2009). There are different cuisines prepared from brinjal so it is a most commonly used as culinary item. Nutritionally, Brinjal is low in energy (30 kcal/100g), protein (1.2%) and vitamin C (5mg/100g), but is a very good source of dietary fibre, potassium, calcium, manganese, copper and thiamin (vitamin B1). In addition to featuring a host of vitamins and minerals, brinjal contains important phytonutrients, many of which are phenolic compounds that functions as anti-oxidants, the pro-dominant one being chlorogenic acid. It is very effective too, when used externally in a fat or a oil based preparation to relieve Haemorrhoid discomfort and also has anti-diabetic property (<http://www.whfoods.com/genpage.php?dbid=22&tname=foodspice>). The fruit of the plant is used as the anti-dote in case of Mushroom poisoning (www.health-galaxy.com/Benefits-of-brinjal.html). Brinjal crop is attacked by number of fungal, bacterial, viral and phytoplasmal diseases, during various growth stages which reduce its yield and quality of fruits. Among all the fungal diseases, *Alternaria* leaf spot, *Alternaria* leaf blight and fruit rot diseases are of regular occurrence in moderate to severe proportion in India and causes extensive damage to the quality of fruits (Pandey and Vishwakarma, 1999). Infected seeds caused reduction in seed germination and yield loss up to 30-50 per cent. (Thippeswamy *et al.*, 2005). *Alternaria* leaf spot caused by *Alternaria alternata*,

Alternaria solani and *Alternaria melongenae*, heavily damage the plants.

Alternaria belongs to the division Deuteromycota with several species. Its multicellular pigmented spores are produced in chains or in branching fashions. The spores are broadest near the base and taper gradually to an elongate beak. When *Alternaria* attacks the host leaf, morphologically it produces a series of concentric rings around the initial site of attack (www.en.wikipedia.org/wiki/Alternaria).

Medicinal plants represents a rich source of antimicrobial agents (Mahesh and satish, 2008). Many of the plant materials are used in traditional medicine are readily available in rural areas at relatively cheaper than modern medicine (Mann *et al.*). But the fungal disease of plants were primarily controlled by the application of fungicides and synthetic compounds which is not an eco-friendly approach as many of them were reported to have carcinogenic, teratogenic, oncogenic and genotoxic properties (Dalvi and Whittakar, 1995). Many of these fungicides are bio-hazardous and adversely affect the components of ecosystem. Further, the cost of these fungicides is comparatively high and their constant application results in development of resistance in the pathogens against these fungicides (Nigam *et al.*, 1994). Thus use of ecofriendly alternative approaches for the management of plant diseases is suggested (Mishra and Tewari, 1990). Thus to explore the efficacy of *Eucalyptus* essential oil against leaf spot (*Alternaria solani*) of *Solanum melongena* L., the present study was laid down.

MATERIALS AND METHODS

Test plant



Fresh leaf of *Eucalyptus* and Brinjal seeds are collected from the research plot at Department of Plant Protection SHIATS campus, Allahabad.

Essential oil isolation

All the Fresh leaf of *Eucalyptus* is collected and is washed under the running tap water and introduced into the conical flask with Alcohol and is plugged out. Then it is dried in direct sunlight for 3 days. After it is collected together and is placed in soxhlet apparatus for the extraction of oil. Then the oil sample is preserved and kept in a sealed vial at 4°C until analysis and tests.

Test fungi

Important and frequently occurring leaf spot of brinjal caused by *Alternaria solani* is selected from the research plot of Department of plant protection SHIATS, Allahabad. Fungus is isolated and the pure culture was maintained on PDA petridish which served as test fungi.

Inoculation

Pathogen after isolation, identification, and mass culturing was artificially inoculated in the soil @40g (8×10^3 /g of soil). The Brinjal seeds were soaked in *Eucalyptus* oil at 4 different concentration@1, 2, 3 and 4% for an hour before 24 hours of sowing. Thus treated seeds were sown in small fibre cups (100g/cup) in 5 treatments and 6 replication including control.

Antifungal activity

The evaluation of antifungal effects of *Eucalyptus* essential oil on the growth of test pathogen was studied after 15, 30 and 45 days, respectively. The fibre cup containing essential oil treated seeds@ 1, 2, 3 and 4% respectively is introduced to *in vivo* condition and has drastic change in the growth and disease manifestation in compare to the control having no treatment.

RESULTS

Among the five treatments including control the disease incidence, disease severity and disease intensity is calculated. Thus it was found that in the cup having 1% and 2% *Eucalyptus* essential oil treated seeds suppresses the growth of fungus and have healthy plant growth respectively in compare to the cup having no oil treated seeds (control) (Table-1). The percentage seedling emergence, plant height, root weight and shoot weight were found highest in the 2% *Eucalyptus* oil concentration while highest root length was observed in 3%. The poor performance at higher concentration (i.e. at 3% and 4% concentration) may be due to toxic effect on plant.

The disease intensity (DI) and Percentage disease incidence (PDI) were also computed (Table-2). Both the disease intensity and percentage disease incidence were found decreasing as the concentration of *Eucalyptus* oil is increasing. Also, it was lower compared to control.

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

Treatment	Seedling emergence (%)	Plant height (cm)	Root length (cm)	Root weight (mg)	Shoot weight (mg)
Control	65	6.0	5.5	0.03	0.13
<i>Eucalyptus</i> oil (1%)	85	10.0	11.0	0.37	0.61
<i>Eucalyptus</i> oil (2%)	95	12.5	13.0	0.46	0.83
<i>Eucalyptus</i> oil (3%)	80	8.5	14.5	0.24	0.45
<i>Eucalyptus</i> oil (4%)	75	7	17.0	0.22	0.35

Table-2. Efficacy of *Eucalyptus* essential oil against leaf spot of brinjal (*Alternaria solani*).

Treatment	Disease incidence (DI)	Percentage disease incidence (PDI)
Control	64.4 ^a	51.4 ^a
<i>Eucalyptus</i> oil (1%)	47.1 ^b	22.2 ^b
<i>Eucalyptus</i> oil (2%)	28.7 ^c	13.4 ^c
<i>Eucalyptus</i> oil (3%)	24.6 ^c	13.9 ^c
<i>Eucalyptus</i> oil (4%)	18.5 ^c	10.4 ^c
Grand mean	36.7	22.2
CV (%)	27.4	22
SE (d)	7.12	3.47
LSD (P(0.05))	15.50 ^{**}	7.56 ^{**}

**significant p <0.01 level of significance



However, phytotoxic effect was seen at treatments of concentration 3% and 4% which was exhibited by stunted growth, yellowing and burning at the plants. The effect of different concentration of Eucalyptus oil concentration can be visualized through photographs

where the effect is clear seen to control the disease occurrence.

Plates

Efficacy of *Eucalyptus* essential oil against *Alternaria solani* causing leaf spot of Brinjal.



Figure-1. Growth of Brinjal seedlings (30 days) in different treatments as compared to control (From left to right control with t1, control with t2, control with t3 and control with t4).



Figure-2. Positive result in growth of seedlings in T1 and T2 compared to control.



Figure-3. Growth retarded and burning problem in T3 and T4 as compared to control due to phytotoxicity.

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