

# Antifungal potential of leaf extract of *Datura stramonium* L., against some important plant pathogenic fungi

Bhawana Sharma, K.K. Srivastava, Neelam Verma,  
Ram Niwas, Meeta Singh

Arid Forest Research Institute, New Pali Road, Jodhpur-342005 (India), Email:  
bhawana@icfre.org

## ABSTRACT

Chemical fungicides are used worldwide for enhance crop yield and control plant diseases. When crops are treated with chemical fungicides over a long period then some fungi develop resistance to these chemicals beside this these chemicals are harmful to other non target microorganism and disturb microbial community of soil. In view of these facts, it is urgent need to discover eco friendly, renewable, indigenously available, easily accessible, non-phytotoxic, relatively cost effective and biodegradable botanicals fungicides. A study was carried out to see antifungal properties of commonly occurring weed, *Datura stramonium* in arid zone against the most important disease causing pathogens *Fusarium* and *Rhizoctonia*. Both the pathogens are soil borne in nature and causing wilt, damping off, root rot disease in many economic important plants. The starter culture of *Fusarium* and *Rhizoctonia* was prepared in PDA medium. Aqueous and alcoholic extract of *D. stramonium* leaves were evaluated for antifungal potentialities against four important plant pathogenic fungi (*Rhizoctonia solani*, *R.bataticola*, *Fusarium solani* & *F.moniliforme*) by poison food technique. The alcoholic extract of datura leaves showed more antifungal activity then aqueous extract. The antifungal activity was assessed in terms of percentage inhibition of fungus growth. Effect of different concentration (10, 20, 30, 40 & 50) of ethanol extract on growth of selected fungi showed that increase in concentration of extract (50% concentration) also increase inhibition of fungus growth. The ethanoilic extract of *D. stramonium* leaf exhibit maximum inhibition against *Rhizoctonia solani* (88%) followed by *Fusarium solani* (76%).

**Keywords:** Antufungal, *Datura stramonium*, Leaf extract, plant pathogens

## INTRODUCTION

Chemical fungicides have been used worldwide for enhance crop production and control plant disease. When fungi are treated with chemical fungicides over a long period, then some fungi develop resistance to these fungicides. These chemicals are also imposing adverse effect on other non target microbes and disturb the microbial community of soil. The negative effect of chemical fungicides on soil microbes is well known [1]. It is well established that these chemicals in higher concentration also adversely affects growth and survival of microorganism present in soil [2]. Due to rain or irrigation these fungicides are also mixed with water and pollute it. These chemicals are also generally difficult to degrade and persist in soil and water for long time and contaminate the environment. These chemicals enter in food chain and through biomagnifications. These chemicals pose threat to human and wildlife. Repeated application may become causes of biodiversity loss. In

view of these facts, it is urgent need to discover eco friendly, renewable, indigenously available, easily accessible, non-phytotoxic, relatively cost effective and biodegradable botanicals fungicides. Plant products have been part of phytomedicine since time of immemorial. These can be obtained from various parts of plant like leaves, root, fruit seeds and bark [3]. Anti fungal compounds from plant origins have little or no side effects on non target soil microorganism Medicinal plants are repository of bioactive compounds containing naturally antifungal properties. A lot of plant extract containing antifungal properties against plant pathogenic fungi have been reported by many workers [4,5]. Bisht and Khulbe reported inhibition of mycelia growth of *Drechslera oryze* by *Juglans regia* in vitro experiments [6]. Out of thousand plant species having medicinal importance, only small portion have been investigated phytochemically and pharmacologically [7].

*Datura stramonium* is a poisonous and wasteland weed, member of solanaceae family. It is also known as thorn apple. It contains toxic and pharmacological properties due to presence of many biologically active compounds such as alkaloids, atropine, scopolamine, tannin, carbohydrate and protlens. Traditionally it is used in many drugs for treatment of skin disorder, ear pain, cough, asthma and fever. Extract of leaves is externally used for injuries, wounds, bleeding and pain, *Datura stramonium* also contain antimicrobial activity [8]. The present study was undertaken to evaluate the inhibitory effect of *Datura stramonium* leaves against four plant pathogenic fungi (*Rhizoctonia solani*, *R.bataticola*, *Fusarium solani* and *F. moniliforme*). These fungi are soil borne in nature and significantly reduce yield and quality in crops. These pathogens are difficult to control because they often survive in soil for many years and causing wilt, damping off, root rot disease in many economic important plant in nursery and field stage both.

## MATERIALS AND METHODS

### Collection of Plant Material

Leaves of *Datura stramonium* were collected from some places of Jodhpur District, Rajasthan, India. Plant samples were identified with the help of taxonomic literature, standard flora and herbarium. Collected material was washed thoroughly with running tap water followed by distilled water to remove dirt. After washing and cleaning, material was shade dried at room temperature and finely ground with help of grinder. Powdered leaves stored in airtight bottles for further use in preparation of extract.

### Preperation of Extracts

Two types of extract aqueous and alcoholic (Ethyl alcohol) were prepared with the help of Soxhlet apparatus and dried with help of water bath and rotary evaporator respectively. Extract were dissolved in DMSO and solution of different concentrations (10, 20, 30, 40 & 50) were prepared. The effect of extract on selected fungi was tested *in vitro* by poison food technique [9].

### Poison Food Technique

Starter culture of selected fungi was prepared in PDA medium. Plant Extract of different concentration was mixed with cooled molten media in conical flask and poured into petriplates and allowed to solidify at room temperature. A mycelium disk of 5 mm diameter was cut out from periphery of actively growing fungus (4-7 days old culture) with the help of cork borer and aseptically plated at centre of each petriplate. Three replication of each treatment were maintained, Plate without extract act as negative control and plate with chemical fungicide (.2%) served as positive control. All petriplates were incubated at 25±1°C for seven days. After incubation the effect

of extract was determined by measuring the radial growth of fungi in test plate and compared with control plate. Colony diameter of fungus in each plate was measured in mm. The antifungal activity was assessed in terms of percentage inhibition. The percentage inhibition was calculated with the help of following formula suggested by Vincet [10]:

$$\text{Inhibition Percent} = I\% = \frac{C-T}{C} \times 100$$

where C= Growth of mycelium in control plate (mm) and T=Growth of mycelium in treatment plate (mm) mean of three plates considered as final reading.

## RESULTS AND DISCUSSION

The antifungal activity of aqueous and alcoholic extract of *Datura stramonium* leaves at five different concentration were evaluated in vitro by Poison Food Technique against four plant pathogenic fungi (*Rhizoctonia solani*, *R.bataticola*, *Fusarium solani* and *F.moniliforme*). The result of this study clearly showed that *Datura stramonium* has ability to inhibit selected fungi in vitro. Both aqueous and ethanolic extract of *Datura stramonium* leaves showed varied result against target fungi. All the ethanolic extracts showed wide range of activity against the targeted fungi as compared to aqueous extract which showed limited antifungal activity. The maximum percentage inhibition with aqueous extract (at 50%) for *Rhizoctonia solani*, was 42%, for *Rhizoctonia bataticola* was 36 % , for *Fusarium solani* was 54.2% and *Fusarium moniliforme* was 42%.

The maximum inhibition percentage with ethanolic extract (50%) for *Rhizoctonia solani*, was 88% for *Rhizoctonia bataticola* was 64.1%, for *Fusarium solani* was 76 % and for *Fusarium moniliforme* was 49.8%. It is clearly indicates that the ethanolic extract of *Datura stramonium* leaves exhibited more antifungal properties against all four fungi then aqueous extract. Effect of different concentration (10%,20%, 30%, 40% and 50%) of ethanol extract on growth of all four fungi showed that inhibition of fungus growth increase with concentration of extract. The ethanolic extract of *D. stramonium* leaf exhibit maximum inhibition against *Rhizoctonia solani* (88%) followed by *Fusarium solani* (76%). All the concentration of ethanolic extract of *Datura stramonium* leaves was found effective in inhibition of mycelia growth over the untreated control plate . However highest concentration of extract(50%) recorded maximum inhibition. Similar effect of various other plant extract against various fungi were reported by other researchers[11] . These types of results were also obtained by many workers [12].

Various workers have documented the antifungal activity of plant extract. Shrivastava et al. evaluate extract of 45 medicinal plant against *Fusarium oxysporium f. sp. Lycopersici* and proved antifungal properties of medicinal plant [13]. These types of results were also obtained by Ranwaane et al about inhibition of *Datura stramonium* extract against fungi. Dhale et al tested extract of *Datura* and *Ocimum* against some vegetable pathogenic fungi (*Fusarium oxysporum* and *Rhizopus stolonifer*) [14]. Janander et al. aqueous leaf extract of *Datura stramonium* was also tested against *Alternaria solani* and *Fusarium oxysporum* [15]. Compounds from plant origin are important source of antifungal agent and they provide a renewable source of useful fungicides as they are known to have minimal or no adverse effect on environment in compare to synthetic fungicides [16].

The present study leads to conclusion in nutshell that ethanolic extract of *Datura stramonium* contain significant antifungal potential against some important plant pathogenic fungi and thus could be used as alternate of chemical fungicides for managment of fungal infection in plant. Further greenhouse and field experiments suggested to investigate in vivo effect of this extract. In future advance research should be carried out on isolation and identification of antifungal compound from this plant.

Table 1. Showing inhibition percentage of ethanolic extract of *Datura stramonium* leaves against selected fungi.

Fungus species	Concentration of extract/Inhibition Percentage					
	Control	10	20	30	40	50
<i>Rhizoctonia solani</i> ,	0	32.4%	48%	66%	72.1%	88%
<i>Rhizoctonia bataticola</i>	0	20%	22.8%	30%	44.5%	64.1%
<i>Fusarium solani</i>	0	22%	34.5%	50%	62%	76%
<i>Fusarium moniliforme</i>	0	10.2%	19%	20%	34%	49.8%

Table 2. Showing inhibition percentage of aqueous extract of *Datura stramonium* leaves against selected fungi.

Fungus species	Concentration of extract/Inhibition Percentage					
	Control	10	20	30	40	50
<i>Rhizoctonia solani</i> ,	0	10%	14.6%	25.2%	31%	42%
<i>Rhizoctonia bataticola</i>	0	10.3%	16%	21.1%	28%	36%
<i>Fusarium solani</i>	0	12%	22%	39%	48%	54.2%
<i>Fusarium moniliforme</i>	0	14%	22.8%	28%	38%	42%

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