



## Efficacy of Different Plant Extracts on Fusarium Wilt caused by *Fusarium oxysporum* in Chillies under Field Condition

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### Abstract

Chilli (*Capsicum annum* L.) is vegetable crop belongs to family Solanaceae. It is an important source of vitamin A and C. In developing countries most of chilli diseases are due to fungal attack and cause severe losses in yield. Fusarium wilt of chilli which is caused by *Fusarium oxysporium* f. sp. *capsici* is an important disease of chilli which causes heavy yield losses in Pakistan. Present research was planned to evaluate effect of different concentrations of plant based phyto-extracts against Fusarium wilt on chilli pathogen under natural field condition. In research trails the leave extract of *Euclayptus globulus*, *Cassia fistula*, *Moringa oleifera*, *Vachellia nilotica* and *Azadirachta indica* were evaluated in the management of fusarium wilt. These trails were planned under Randomized Complete Block Design (RCBD). Three concentrations of above mentioned leaf extracts were used 20%, 30% and 40%. At 40% Eucalyptus, Moringa and Azadiracta gave best results with maximum reduction in Fusarium wilt. While all other extracts results were also satisfactory. So we can use these botanicals as a control for this disease in chilli.

**Keywords:** *Capsicum annum*, Fusarium wilt, *Fusarium oxysporium*, Phyto-extracts.

### Introduction

Chilli (*Capsicum annum* L.) is a member of the Solanaceae family and this is one of the most common spice crops with a high commercial value. Family solanaceae has 2800 species including potatoes, eggplant, pepper, tomatoes etc. (Van Der Hoeven *et al.*, 2002 and Baloch, 1996). Chilli major genus capsicum has almost 27 species, out of these 5 species named as *Capsicum frutesense*, *C. annum*,

*C. chinense*, *C. pubesense* and *C. baccatum* are mainly cultivated worldwide and out of these five *Capsicum annum* is most cultivated specie (Tong and Bosland, 1999). Chilli main growing countries are North America, Africa, Latin America, Europe and Asia (FAOSTAT, 2013, FAOSTAT, 2019). Chilli has good nutritional value and its fruits are high in vitamin A and C, as well as a significant amount of calcium, phosphorus, and iron, whereas hot chillies contain the digestive stimulant capsaicin (Ahuja *et al.*, 2006).

It has more vitamin C than citrus when it is green and also has more vitamin A than citrus when chilli is red (Osuna- Garcia *et al.*, 1998).

Chilli production has been reduced due to a variety of biotic and abiotic factors, especially fungal disease issues (Hussain and Abid, 2011). Fungal infection causes most destructive losses in chilli i.e., root rot, leaf spot, blight, anthracnose, powdery mildew, downy mildew damping off, and wilt diseases caused by fungi (Amini and Sidovich, 2010). Cause numerous economic losses throughout the world. Among them *Fusarium* wilt which is very destructive disease and cause high yield losses (Di Pietro *et al.*, 2003). One 3<sup>rd</sup> disease of chilli due to fungal attack and cause 25% yield losses that is almost 50% in developing countries. Wilt disease of chilli in dry growing area of Pakistan losses from 15-20%. Wilt of chilli caused by a fungi *Fusarium oxysporium f.sp. capsici* is a homothallic fungus reproduce asexually by mean of conidia on conidiophores. It produces three types of spores microspores, macrospores and chlamydo spores. (Nikam *et al.*, 2011).

Management of fusarium wilt can be done by cultural practices and also with the help of chemicals (Kamal *et al.*, 2009). But these chemicals have adverse effect on environment. Plant extracts are being used against fungal diseases since long ago (Nasrin *et al.*, 2018). These extracts are eco-friendly (Ali *et al.*, 2013). Neem extracts and willow extracts used against *Fusarium* wilt on tomatoes and resulted that Neem Extract and willow extracts reduced spreading of disease. Data was recorded after 2,4 and 6 six weeks after inoculation. In non-treated seedlings disease incidence reached upto 65% within six weeks while in neem and willow aqueous extracts disease incidence percentage was reduced to the level of 25.6% and 27.8 % (Hanna *et al.*, 2011).

## Materials and Methods

Samples of symptomatic Chilli plants were collected from experimental area of Department Plant Pathology UAF and from the field area of District Layyah. Isolation was made from the infected plant parts. The diseased samples were cut into 4-6 cm small pieces. Then dipped in distilled sterile water and were dried on sterilized blotter paper and transferred those small pieces of infected plant parts on the PDA media in petri plates and incubated at 26°C ± 2 per day for the growth of the colony. Then the purification was done by a single-spore technique.

The pathogenicity test of *Fusarium oxysporium f. sp. capsici* was performed using an isolated pathogen inoculated in a healthy Chilli plant. Symptoms of the disease were occurred within few weeks. Symptoms of infection were noted after an interval of 7 days. Pathogen was also isolated again for pathogen conformation. Fresh leaves of above mentions species were collected. These leaves were washed, dried and grinded to make powder. Then methanolic extract for each specie was prepared. Hundred grams of dried leaves powder of each specie will be soaked in 100 ml of 100 percent methanol overnight. Then 50 ml of each extract transferred to a clean vessel, evaporated to dryness, redissolved in dimethyl sulfoxide to get 10 mg/ml. Then methanolic extract of each specie was dissolved in sterilized water to prepare desired concentration. Healthy plants of chili were grown in the green house and in the open field. The experiment was conducted using (RCBD). Pots were filled with organic soil. Chilli plants were planted in pots and open fields. After planting, the plants were inoculated with *Fusarium oxysporium f. sp. Capsici* at different concentrations. Three readings were taken at an interval of seven days.

Least significance difference (LSD) with 5% significance level is used for comparing the means of treatments.

## Results and Discussion

This research was planned to study effect of different plant extracts against *Fusarium* wilt. This trial was conducted under natural field conditions at research area of Department of Plant Pathology university of Agriculture Faisalabad. Chilli plants sowing in the field was done under Randomized Complete Block Design (RCBD). Three concentrations of all plant extracts were used which were 20%, 30% and 40 %. Three replications of each concentration of all plant extracts were used. Data of each concentration was recorded on weekly basis. First data was recorded 01 week after application of treatment while last data was recorded 03 weeks after application of treatment. Eucalyptus, Moringa and Azadirachta gave best result to reduce this disease during this field study at all three concentrations. While Vachellia and Cassia gave satisfactory results.

**Table 1: Analysis of Variance Table for all Concentrations of different Plant Extracts Against Disease Reduction (%) of *Fusarium oxysporum* after 3 Weeks in *In-vivo* Conditions**

Source	DF	SS	MS	F	P
Replication	2	364.78	182.39		
Treatments (T)	5	3955.28	791.06	10.26	0.0000**
Concentrations (C)	2	2493.44	1246.72	16.17	0.0000**
T x C	10	379.44	37.94	0.49	0.88 <sup>NS</sup>
Error	34	2621.89	77.11		
Total	53	9814.83			

CV =20.72, NS =Non-significant (P>0.05); \*\*=Highly significant (P<0.05)

Table 1 showed the Analysis of Variance (ANOVA) for all Concentrations of different Plant Extracts Against disease reduction (%) of *Fusarium oxysporum* after 03 weeks in *In-vivo* Conditions. All these plant extracts were applied at 20%, 30% and 40%.03 weeks

after treatment of all concentrations data were recorded for disease reduction (%). The results of ANOVA showed a highly significant relationship among treatments and also a non-significant relationship between treatments and concentrations.

**Table 2: All Pairwise comparison of Means of Interaction of Plant Extracts and Their concentrations (Extract x Concentration) in *In-vivo* conditions**

	Concentration	Incidence (%)	Reduction (%)
Eucalyptus	20 %	65.00 bcd	35.00 def
	30 %	47.00 efg	53.00 abc
	40 %	40.66 g	59.33 a
Cassia	20 %	61.33 bcde	38.66 cdef
	30 %	60.00 cde	40.00 cde
	40 %	50.33 efg	49.66 abc
Moringa	20 %	58.00 cdef	42.00 bcde
	30 %	49.66 efg	50.33 abc
	40 %	40.66 g	59.33 a
Vachellia	20 %	68.00 abc	32.00 efg
	30 %	58.33 cdef	41.66 bcde
	40 %	49.66 efg	50.33 abc
Azadirachta	20 %	65.33 abcd	34.66 defg
	30 %	52.00 defg	48.00 abcd
	40 %	45.00 fg	55.00 ab
Control	20 %	79.66 a	20.33 g
	30 %	75.00 ab	25.00 fg
	40 %	71.33 abc	28.66 efg
LSD @ 5%		14.57	14.57

Mean values having same letters shows that these are statistically non-significant whereas the mean values with different letters shows that these are statistically significant.

Table 2 represents all Pairwise comparison of Means of Interaction of Plant Extracts and Their concentrations (Extract x Concentration) in *In-vivo* conditions. All plants extracts were used at three concentrations 20%, 30% and 40% results showed that disease incidence (%) was minimum at 40%

concentration of all plant extracts. Eucalyptus and Moriga gave best results (40.66%) disease incidence each, followed by Azadirachta (45.00%). Whereas Vichellia and Cassia showed disease incidence (49.66%) and (50.33%) respectively. In disease reduction (%) at 40% concentration Eucalyptus and

Moringa gave best results (59.33%) each, followed by Azadirachta (55.00%). Whereas Vachellia and Cassia showed (50.33%) and (49.66%) disease reduction respectively.

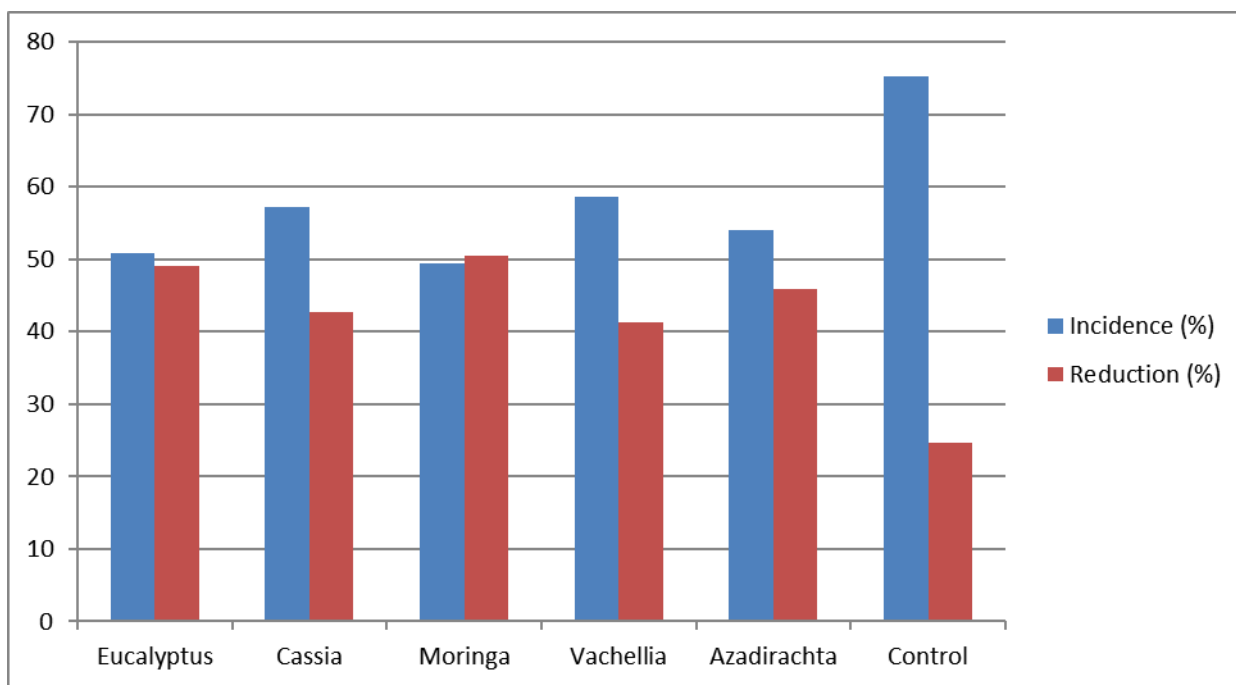
**Table 3: All Pairwise comparison of Means of Plant Extracts in *In-vivo* conditions**

Plant Extracts	Incidence (%)	Reduction (%)
Eucalyptus	50.88 bc	49.11 ab
Cassia	57.22 bc	42.77 ab
Moringa	49.44 c	50.55 a
Vachellia	58.66 b	41.33 b
Azadirachta	54.11 bc	45.88 ab
Control	75.33 a	24.66 c
LSD @ 5%	8.41	8.41

Mean values having same letters shows that these are statistically non-significant whereas the mean values with different letters shows that these are statistically significant.

Table 3 represents all Pairwise comparison of Means of Plant Extracts in *In-vivo* conditions. The results in this table showed that Azadirachta, Eucalyptus and Cassia showed statistically non-significant comparison

in disease incidence (%) as well as in disease reduction (%). While Vachellia and Moringa showed significant behavior both in disease incidence and disease reduction in all concentrations.



**Figure 1: Graphical representations for disease incidence (%) and Reduction (%) of *Fusarium oxysporum* by applying different plant extracts In-vivo conditions.**

### Conclusion

All tested plant extracts were effective to control *Fusarium* wilt. However, extracts of Eucalyptus, Azadirachta and Moringa gave the best results. These plant extracts are eco-friendly and can be easily used to control fungal diseases in edible products.

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