Available online freely at www.isisn.org

Bioscience Research

Print ISSN: 1811-9506 Online ISSN: 2218-3973

Journal by Innovative Scientific Information & Services Network

RESEARCH ARTICLE BIOSCIENCE RESEARCH, 2022 19(2):1030-1033. **OPEN ACCESS**

Use of various plant extracts to inhibit growth of Fusarium Wilt caused by *Fusarium oxysporum* in Chillies under laboratory conditions

Nouman Malik[1], Amer Habib[1], Muhammad Kamil Malik[2], Muhammad Zubair[2*], Sikander Ali[2], Qamar Anser Tufail Khan[2], Huma Qamar[2], Sidra Iqbal[3], Muhammad Amin [4], Kanwal Hanif[5], Muhammad Rizwan Khurshid[2] and Tariq Mahmood[2]

[1]Department of Plant Pathology, University of Agriculture Faisalabad, **Pakistan**
[2]Oilseeds Research Institute Faisalabad, **Pakistan**
[3] Institute of Soil and Environmental Sciences, University of Agriculture Faisalabad, **Pakistan**
[4]Vegetable Research Institute Faisalabad, **Pakistan**
[5]Entomological Research Institute Faisalabad, **Pakistan**

***Correspondence:** chzubair92@gmail.com **Received 09-04-2022, Revised:21-05-2022, Accepted: 22-05-2022 e-Published: 23-05-2022**

Chilli (*Capsicum annuum L.*) is good source of vitamins; A and C. Mostly, fungal attacks cause severe yield losses. Fusarium wilt caused by *Fusarium oxysporium f. sp. Capsica*. The current study was planned to evaluate the potential of different plant extracts against Fusarium wilt on chilli's pathogen under laboratory conditions. The leaf extract of *Eucalyptus globulus, Cassia fistula, Moringa oleifera, Vachellia nilotica* and *Azadirachta indica* were evaluated for the management of fusarium wilt. Three different concentrations; 5%, 10% and 20% were evaluated for their efficacy. At 20%, *Eucalyptus* and *Azadiractin* gave the best results with maximum reduction in Fusarium wilt. While all other extracts' results were also satisfactory. Thus, it is concluded that these botanicals can be used as a tool to control this disease in chilli while saving the crop from use of hazardous chemicals.

Keywords: Chilli, Fusarium wilt, *Fusarium oxysporum*, Botanicals.

INTRODUCTION

Chilli (*Capsicum annuum* L.) is regarded as a major spice in Asia, due to its excessive use Chilli has high commercial value. Solanaceae has a vast range of species and has 2800 species worldwide which includes tomatoes, pepper, potatoes, and brinjal (Van Der Hoeven et al. 2002 and Baloch, 1996). This crop was originated from America and spread worldwide. It is one of the important genus of family Solanaceae. This Genus is common in temperate, tropics and sub- tropics region equally, further containing species and sub-species (Pickergill, 1997). World-wide total cultivation area of chilli is 372.99 thousand hectares out of this 170 thousand hectares is of fresh chilli and 202 thousand hectares for dried chilli. Annual production of chilli is 2000 tons (FAOSTAT, 2013). *C. annuum* have Pharmacological effects it has antioxidant compound which prevent several diseases for example cancer and cardiovascular disease because it contains anti-cardiac and anticancer compounds which found in green chilli plants (Biswas et al. 2011). It is considered as a major source of vitamin C and has more vitamin C than citrus and also a good source of vitamin a when it ripen and turns into red colour (Osuna- Garcia et al. 1998).

Due to some biotic and abiotic factors Chilli production has been reduced. Fungal diseases like leaf blot, wilt diseases, powdery mildew, downy mildew and anthracnose are considered as one of the major factors in its yield losses (Hussain and Abid, 2011). Fusarium wilt is considered most destructive disease of chilli worldwide, which may reduce the production upto 50 % (Di Pietro et al. 2003). This is very common in main growing areas of Pakistan caused by Fusarium oxysporum f.sp. *capsici* (Nikam et al. 2011).

It is controlled by both chemicals as well as cultural practices (Kamal et al. 2009). Plant extracts are useful for control (Ali et al. 2013, Nasrin et al. 2018). Neem extracts and willow extracts used against Fusarium wilt on

tomatoes and results were very effective (Hanna et al. 2011).

The issue of how to treat seedling diseases of chillies caused by Fusarium spp. in an effective, healthy, cost-effective, and easy-to-control manner remains unanswered. Previous analysis, on the other hand, has been limited to one or two plant or plant component extracts. Thus, the aim of this study was to see how different plant extracts affect the pathogen to development. These plant extracts are eco-friendly and had antifungal compounds for controlling the most common *Fusarium oxysporum* f. sp. *capsici.*

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 size of 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 oxysporum 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 a week's interval. Pathogen was also isolated again for pathogen conformation. Fresh leaves were collected, washed, dried and grinded to make powder. Then, methanolic extract for each plant was prepared. Hundred grams of dried leaves powder of each entry was 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 was dissolved in sterilized water to prepare desired concentration. Five plant extracts were assessed in the laboratory against *Fusarium oxysporum* f. sp. *capsici* extracts were evaluated using the inhibition zone technique. The experiment was conducted using (CRD). Three concentrations of each extract were prepared. The pieces of blotter paper were autoclaved and dipped in each concentration of plant extract and placed in the center of the media plate streaked with *Fusarium oxysporium f. sp. capsici*. The plates were incubated, and three observations were taken 24 hours apart.

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

RESULTS AND DISCUSSION

This present study was planned to check efficacy of various plant extracts against *Fusarium oxysporium f. sp. capsici*. The experiment was conducted under Laboratory conditions at Department of Plant Pathology university of Agriculture Faisalabad. Three concentrations of five plant extracts were used which were 05%, 10% and 20 %. This experiment was conducted by using Complete Randomized Design (CRD). Data for growth inhibition of *Fusarium oxysporum* of each concentration was recorded after 24, 48 and 72 hours after application of each treatment. First data was recorded 24 Hours after application of treatment while last data was recorded 72 Hours after application of treatment. Eucalyptus and Azadirachta gave best result to reduce this disease during this field study at all three concentrations. While Moringa, Vachellia and Cassia gave satisfactory results at 72 Hours after application of treatment.

Table 1 showed the Analysis of Variance (ANOVA) for all Concentrations of different Plant Extracts against Reduction (%) of *Fusarium oxysporum* after 72 hours in In-vitro Conditions. All these plant extracts were applied at 5%, 10% and 20%.72 hours 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 highly significant relationship between treatments and concentrations.

Table 1: Analysis of Variance Table for all Concentrations of different Plant Extracts against Reduction (%) of *Fusarium oxysporum* after 72 hours in *In-vitro* Conditions

Source	DF	SS	MS	F	P
Replication	2	10.1	5.06		
Treatments (T)	**5**	7360.0	1472.02	272.55	0.0000**
Concentrations (C)	2	3597.2	1798.62	333.02	0.0000**
T x C	10	850.5	85.05	15.75	0.0000**
Error	34	183.6	5.40		
Total	53	12001.5			

CV =9.22, NS =Non-significant (P>0.05); **=highly significant (P<0.05)

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

	Concentration	Incidence (%)	Reduction (%)
Eucalyptus	5 %	77.00 de	23.00 ef
	10 %	68.00 g	32.00 c
	20 %	52.29 i	47.71 a
Cassia	5 %	81.52 bc	18.48 gh
	10 %	72.78 f	27.22 de
	20 %	61.62 h	38.38 b
Moringa	5 %	79.11 cd	20.89 fg
	10 %	74.55 ef	25.45 de
	20 %	58.74 h	41.26 b
Vachellia	5 %	84.07 b	15.93 h
	10 %	77.44 de	22.56 ef
	20 %	61.22 h	38.78 b
Azadirachta	5 %	78.26 cde	21.74 efg
	10 %	70.92 fg	29.08 cd
	20 %	48.93 i	51.07 a
Control	5 %	100.00 a	0.00 i
	10 %	100.00 a	0.00 i
	20 %	100.00 a	0.00 i
LSD @ 5%		3.85	3.85

Mean values with different letters shows that these are statistically significant.

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

Plant Extracts	Incidence (%)	Reduction (%)
Eucalyptus	65.76 d	34.24 a
Cassia	71.97 c	28.03 b
Moringa	70.80 c	29.20 b
Vachellia	74.25 b	25.75 c
Azadirachta	66.04 d	33.96 a
Control	100 a	0.00 d
LSD @ 5%	2.22	2.22

Mean values with different letters shows that these are statistically significant.

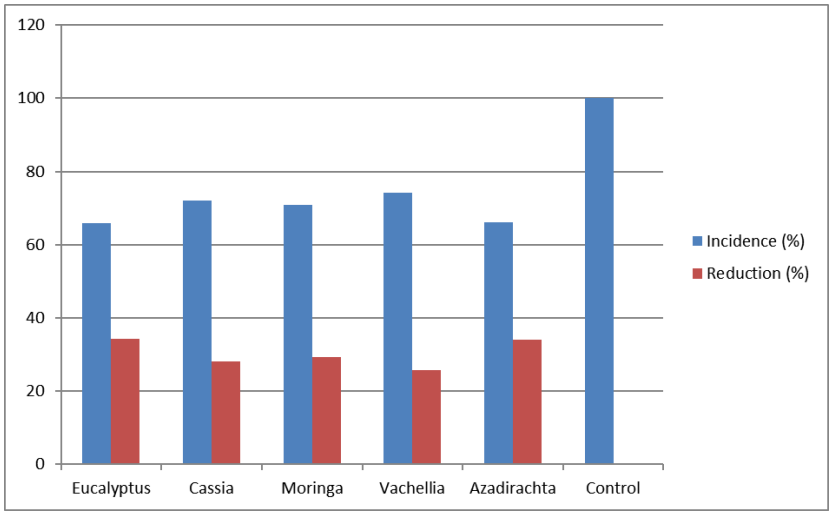

Figure 1: Graphical representations for disease incidence (%) and Reduction (%) of *Fusarium oxysporum* by

applying different plant extracts In-vitro conditions.

Table 2 represents all Pairwise comparison of Means of Interaction of Plant Extracts and Their concentrations (Extract x Concentration) in In-vitro conditions. All plants extracts were used at three concentrations 5%, 10% and 20%. Results showed that disease incidence (%) was minimum at 20% concentration of all plant extracts. Azadirachta gave best results (48.93%) disease incidence, followed by Eucalyptus (52.29%). While Moringa, Vichellia and Cassia showed (51.72%), (61.22% and (61.62%) respectively. In disease reduction (%) at 20% concentration Azadirachta gave best results (51.07%), followed by Eucalyptus (47.71%). Whereas Moringa, Vachellia and Cassia showed (41.26%), (38.78%) and (38.38%) respectively. Similarly in 5% and 10% Azadirachta and Eucalyptus gave best results in reduction of disease. 100% disease incidence was observed in all control with no disease reduction %.

Table 3 represents all Pairwise comparison of Means of Plant Extracts in In-vitro conditions. The results in this table showed that Azadirachta, Eucalyptus and Vachellia showed statistically significant comparison in disease incidence (%) as well as in disease reduction (%). While Moringa and Cassia showed non-significant behavior both in disease incidence and disease reduction in all concentrations.

CONCLUSION

All used plant extracts were effective to control Fusarium wilt in this Laboratory experiment. Eucalyptus and Azadirachta gave best results. These plant extracts are eco-friendly and can be easily used to control fungal diseases in edible products.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

AUTHOR CONTRIBUTIONS

NM, AH and MKM designed the study. NM, MZ, QAT conducted the experiment. and performed the experiments and also wrote the manuscript. HQ, SI and MA wrote the manuscript. KH and MRK analyzed the data and finalized the manuscript. AH, SA and TM supervised the study and proofread the manuscript. All authors read and approved the final version.

REFERENCES

Ali, M. O. H. D., M. E. H. I. Lal, A. N. I. S. Khan, V. I. V. E. K. Singh and P. K. Singh. 2013. Evaluation of leaf extracts and essential oils against *Fusarium oxysporum* f. sp. pisi–the causal agent of pea wilt. Indian Phytopath., 66(3): 316-318.

Baloch, A. 1996. Vegetable crops in “Horticulture”,(Ed: Elena, B, and R. Bantel) NBF. Islamabad.

Biswas, A., A. Bhattacharya, A. Chattopadhyay,A. Chakravarty and S. Pal. 2011.Antioxidants and antioxidant activity in green pungent peppers. Int. J. Veg. Sci.,17: 224-232.

Di Pietro, A., M.P. Madrid, Z. Caracuel, J. Delgado-Jarana and M.I.G. Roncero. 2003. Fusarium oxysporum: Exploring the molecular arsenal of a vascular wilt fungus Molecular Plant Patho. 4, 315–325.

Food and Agricultural Organization of the United Nations (FA0). 2013. FAOSTAT databaseresult of chilies and peppers. Retrieved May 13, 2013.

Hanaa, F., R. M., Z. A. Abdou, D. A. Salama, M. A. R. Ibrahim and H. A. M. Sror. 2011. Effect ofNeem and Willow Aqueous Extracts On Fusarium Wilt Disease In Tomato Seedlings: Induction of Antioxidant Defensive Enzymes. Ann. Agri. Sci. 56: 1-7.

Hussain, F. and M. Abid. 2011. Pest and diseases of chilli crop in Pakistan: A review. Int. J. Biol. Biotech, 8: 325-332.

Kamal, A.H.M., K.H. Kim, K.H. Shin, H.S. Seo, H. Tsujimoto, H.Y. Heo, J.S. Choi, C.S. Park and S.H. Woo. 2009. Diversity of novel glutenin subunits in bread wheat (Triticum aestivum L.). J. Plant. Bio., 52: 533-542.

Nasrin, L., S. Podder and M. R. Mahmud. 2018. Investigation of Potential Biological Control of Fusarium Oxysporum f.sp. Lycopersici by Plant Extracts, Antagonistic sp. and Chemical Elicitors In Vitro. Fungal Genome Biol. 8(1): 222-225.

Nikam, P., G. Jagtap and P. Sontakke. 2011. Survey, surveillance and cultural characteristics of chickpea wilt caused by Fusarium oxysporium f. sp. ciceri. Afri.J.Agric.Res, 6: 1913-1917.

Osuna-Garcia. J. A., M. W. Wall, C. A. Wadell. 1998. Endogenus levels of tochopherols and ascorbic acid during fruit rippening of new Maxican type chili (Capsicum annum) cultivars. J . Agric. Food Chem. 46(12): 5093-5096.

Pickergrill, B. I 997.Genetic resources and breeding of Capsicum spp. Euphytica, 96 (1): 129- 133.

Van der Hoeven, R. S., C. Ronning, J. J. Giovannoni and S. D. Tanksley. 2002. Deductio about the number organization, and evolution of genes in the tom ato genome based.