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Management of coriander wilt (*Fusarium oxysporum*) through plant extracts and source of resistance

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Abstract
Wilt of coriander incited by *Fusarium oxysporum* is one of the important disease and a big constraint in successful cultivation. In our investigation four plant extracts in both *in vitro* and *in vivo* were tested against wilt disease of coriander. *Azadirachta indica* leaf extract was found most effective followed by *Allium sativum* cloves extract in both conditions and *Ocimum tenuiflorum* were found least effective among these plant extracts. *Azadirachta indica* leaf extract recorded *in vitro* inhibition the mycelial growth (56.33%), and *in vivo* 18.27 percent disease incidence with 64.81 percent disease control and 788.35 kg/ha seed yield by increasing 135.79 percent seed yield. Thirty coriander genotypes/varieties were screened against *Fusarium oxysporum* under artificial inoculation conditions in field. On the basis of two years observations, it was recorded that four of the genotypes/varieties were resistant (R) RCr-446, RCr-684, RCr-20, RCr-41 were categorized, nineteen genotypes/varieties *viz.* RCr-475, RCr-480, RCr-728, UD-796, RD-366, UD-426, UD-483, CO-3, UD-743, UD-744, DH-246, NS-2, UD–728, UD-775, UD-630, UD-707, DH-208, RD-120 and RD-154 as moderately resistant, four genotypes/ varieties *viz.,* NS-1, J.Co-387, Co-2, and UD-529 as susceptible and rest three genotype/varieties *viz.,* RCr-435, RCr-446, DH-205 as highly Susceptible.

Keywords: Coriander, *Fusarium oxysporum,* Plant extracts, host resistance

Introduction
Coriander (*Coriandrum sativum* L.) popularly known as "*dhania*" is one of the oldest seed spice used by the mankind that belong to family 'Apiaceae' synonym to 'Umbelliferae'. The fresh green stems, leaves and fruits of coriander have a pleasant aromatic odour. The pleasant aroma in the plant is due to an essential oil called 'coriandrol' which ranges from 0.1 to 1.3 percent in dry seeds. The oil of coriander seeds is a valuable ingredient in perfumes, cosmetic products, soup, candy, cocoa, chocolate, meat products, soft drinks and alcoholic beverages. Coriander bark oil has high germicidal activity and can be used as fungicide (Krishna De, 1999) [5]. The wilt disease causes up to 60 percent yield loss in coriander (Manoranjitham *et al*., 2003) [6]. The seed yield losses caused by *Fusarium* wilt ranges from 5 to 60 percent in Rajasthan and 15 to 25 percent in Gujarat (Prasad and Patel, 1963) [8].

Material and methods
Plant extracts and their Concentration

Table 1

S. No	Common name	Trade Name	Part used	Concentration (%)	
				In vitro	*In vivo*
1	Neem	*Azadirachta indica*	Leaves	5, 10, 15	15
2	Garlic	*Allium sativum*	Cloves	5, 10, 15	15
3	Datura,	*Datura stramonium*	Leaves	5, 10, 15	15
4	Tulsi	*Ocimum tenuiflorum*	Leaves	5, 10, 15	15

Preparation of the plant extracts
Plant materials such as fresh leaves/cloves of botanicals under test were harvested and thoroughly washed in tap water. Hundred gram from each was collected and washed 2-3 times with water and allowed to dry at room temperature (25±1 °C) for six hours. Before extraction leaves of each plant (100g) were crushed separately with 100 ml sterilized distilled water. The extract was filtered through muslin cloth and centrifuged at 5000 rpm for 15 min. The extract were then sterilized by passing them through a Millipore filter using a swimming filter adapter. The supernatant obtained was collected and stored at 5 ^{0}C for further use. Seeds were separately soaked in leaf/cloves extract for 24 h at 25±1 ^{0}C.

In vitro* effect of plant extracts against *Fusarium oxysporum* f. sp. *coriandrii

The extract of each plant species was diluted in order to achieve three concentrations viz., 5, 10 and 15 per cet. Petri plates containing PDA supplemented with different phyto-extracts, each with three concentrations and replicated four times were inoculated with 7 day old culture (5 mm dia disc). A suitable check was also maintained. Fungal colony was measured after 7 days of incubation at 25±1°C. The liner growth of test fungus was recorded and percent growth inhibition was calculated by formula given below

$$\text{Percent growth inhibition} = \frac{C - T}{C} \times 100$$

Whereas,
C = Diameter of the colony in check (average of both diagonals)
T = Diameter of colony in treatment (average of both diagonals)

Effect of plant extracts under field conditions (*In vivo*) against *Fusarium oxysporum* f. sp. *coriandrii*

In the experimental plots, field trials were conducted during winter season of 2013-14 and 2014-15 at Agronomy farm, SKN College of Agriculture, Jobner in randomized block design (RBD). The seeds of coriander (RCr-435) of treated with different plant extracts were separately sown in the plots. Untreated seeds sown under similar conditions served as control. Usual agronomical practices were followed in preparation of the field. In both the years, the experiments were sown in the third week of November. Observations on disease incidence were recorded periodically up to 90 days after sowing and after harvest grain yield was also recorded.

$$\text{Percent disease incidence} = \frac{\text{Number of infected plants}}{\text{Total number of plants observed}} \times 100$$

Through source of resistance

Thirty germplasm/variety of coriander *viz.* RCr-20, RCr-41, RCr-435, RCr-436, RCr-446, RCr-475, RCr-480, RCr-684, RCr-728, UD-796, RD-366, UD-426, UD-483, CO-3, UD-743, UD-744, DH-246, NS-2, UD–728, UD-775, UD-630, UD-707, DH-208, RD-120, RD-154, NS-1, J.Co-387, Co-2, UD-529 and DH-205 were collected from AICRP on seed spices, SKN College of Agriculture, Jobner were evaluated against wilt under wilt sick plot condition during rabi 2013-14 and 2014-15. Inoculum multiplied on sand maize meal medium was placed in furrows at 8-10 cm depth @ 200 g/2 m row length to increase the disease pressure. The experiment was replicated twice. Observations were recorded after 30 days of sowing. On the basis of disease incidence the were categorized as per criterion followed by Iqbal *et al*., (2005) [4].

Table 2

Rating scale	Disease incidence (%)	Category
1	0-10	Highly resistant (HR)
3	11-20	Resistant (R)
5	21-30	Moderately resistant (MR)
7	31-50	Susceptible (S)
9	>50	Highly susceptible (HS)

Results and discussion

In vitro* effect of Plant extract against *Fusarium oxysporum* f. sp. *corianderii

Effect of plant extracts was tested at 5, 10, and 15 percent concentration against inhibition of mycelial growth of *Fusarium oxysporum* f.sp. *corianderii* by poison food technique. The *Azadirachta indica* leaf extract was found significantly superior in inhibition the mycelial growth (56.33%), followed by *Allium sativum* clove extract (48.18%) and *Datura stramonium* (42.22%). *Ocimum tenuiflorum* leaf extract was found least effective (35.16%) against inhibition of mycelial growth of the fungus. As the concentration of plant extracts increased, the inhibition of mycelial growth decrease (table 3).

Table 3: *In vitro* efficacy of plant extracts against *Fusarium oxysporum* f. sp. *corianderii*

Plant extracts	Percent inhibition of mycelial growth* at different Concentration (percent)			Mean
	5 %	10 %	15 %	
Azadirachta	35.64	46.90	58.15	56.33
indica	(36.65)	(43.22)	(49.69)	
Allium sativum	30.17	40.21	50.24	48.18
	(33.32)	(39.35)	(45.14)	
Datura	25.40	33.51	41.61	42.22
stramonium	(30.26)	(35.37)	(40.17)	
Ocimum	21.54	25.90	30.25	35.16
tenuiflorum	(27.65)	(30.59)	(33.37)	
Control	0.00	0.00	0.00	
	(0.00)	(0.00)	(0.00)	
SEm±	0.59	0.56	0.66	
CD (p=0.05)	1.83	1.73	2.04	

* Average of four replications
Figures given in parenthesis are angular transformed values

In vivo* effect of Plant extract against *Fusarium oxysporum* f. sp. *corianderii

Effect of different plant extracts at 15 percent concentration was tested against wilt of coriander under field conditions. Results of pooled analysis showed that minimum disease incidence was recorded in *Azadirachta indica* leaf extract (18.27%). Maximum percent disease incidence was recorded in *Ocimum tenuiflorum* leaf extract (29.42%) (Table 4). Two

year pooled analysis of seed yield data indicated that highest seed yield was recorded with *Azadirachta indica* leaf extract (788.35 kg/ha) and *Ocimum tenuiflorum* leaf extract was found lowest (542.70 kg/ha) (Table 4). Among the *Azadirachta indica*, leaf extract was found most effective to inhibit (56.33%) followed by *Allium sativum* (48.18%) mycelia growth of fungus *in vitro* and *Azadirachta indica*, leaf extract (64.81%) percent disease control under field condition and maximum 788.35kg/ha seed yield, followed by *Allium sativum* (53.69%) disease control under field condition and 728.85 kg/ha seed yield. These results were also confirmation by Dwivedi and Shukla (2000) [3] that the leaf extract of *Azadirachta indica* at 100% concentration was completely inhibit the spore germination of *Fusarium spp*. while *Allium sativum* leaf extract partially inhibited spore germination *F. equseti*. Ramaiah and Garampalli (2015) [9] tested fifteen plant extracts *in vitro* against *Fusarium oxysporum f. sp. Lycopersici*. Out of fifteen plant extracts, three plant extracts proved to be potential in inhibiting the growth of the pathogen *viz., Solanum indicum* (78.33%), *Azadirachta indica* (75.00%), *Oxalis latifolia* (70.33%).

Table 4: Effect of seed treatment with Plant extracts on wilt disease incidence and seed yield of coriander under field condition

Plant extracts	Concentration (percent)	Percent disease incidence*			Decrease in PDI over control (percent)	Yield (kg/ha)*			Increase in yield over control (percent)
		2013-14	2014-15	Pooled		2013-14	2014-15	Pooled	
Azadirachta indica	15	19.30	17.23	18.27	64.81	764.40	812.30	788.35	135.79
		(26.06)	(24.53)	(25.30)					
Allium sativum	15	25.67	22.41	24.04	53.69	698.50	759.20	728.85	117.99
		(30.44)	(28.25)	(29.36)					
Datura stramonium	15	27.31	24.50	25.91	50.10	595.10	607.90	601.50	79.90
		(31.51)	(29.67)	(30.60)					
Ocimum tenuiflorum	15	30.13	28.70	29.42	43.33	536.60	548.80	542.70	62.31
		(33.29)	(32.39)	(32.84)					
Control	-	54.49	49.33	51.91		317.50	351.20	334.35	
		(47.58)	(44.62)	(46.09)					
SEm±		0.93	1.03	1.05		18.41	18.40	18.36	
CD (p=0.05)		2.87	3.19	3.23		56.72	56.67	56.58	
CV (%)		5.52	6.49	6.39		6.32	5.97	6.13	

* Average of four replication
Figures in parenthesis are angular transformed value

Table 5: Screening of coriander the genotypes/ varieties against wilt incited by *Fusarium oxysporum* f.sp. *corianderii*

Genotypes/ varieties	Disease incidence (%)			Disease Reaction
	2013-14	2014-15	Mean	
RCr-446	12.50	10.30	11.40	R
RCr-684	13.30	11.75	12.52	R
RCr-20	12.95	13.20	13.07	R
RCr-41	17.77	15.30	16.53	R
RCr-475	22.90	24.33	23.61	MR
RCr-480	23.80	25.15	24.47	MR
RCr-728	26.20	25.00	25.60	MR
NS-2	24.15	26.40	25.27	MR
DH-208	27.30	26.15	26.72	MR
UD-426	26.10	28.45	27.27	MR
UD-483	22.65	22.00	22.32	MR
CO-3	21.22	21.55	21.38	MR
UD-630	28.33	27.21	27.77	MR
UD-707	29.42	27.11	28.26	MR
UD-728	20.11	24.70	22.40	MR
UD-743	26.15	29.84	27.99	MR
UD-744	27.34	24.16	25.75	MR
UD-775	21.55	25.80	23.67	MR
UD-796	24.90	27.33	26.11	MR
RD-120	29.75	29.00	29.37	MR
RD-154	24.35	26.49	25.42	MR
RD-366	26.20	25.15	25.67	MR
DH-246	26.90	28.30	27.60	MR
UD-529	37.50	33.24	35.57	S
NS-1	35.65	39.80	37.72	S
J.Co-387	44.15	41.20	42.67	S
Co-2	49.15	45.25	47.20	S
RCr-435	55.90	51.40	53.65	HS
RCr-436	56.40	54.30	55.10	HS
DH-205	51.33	50.10	50.71	HS

Highly resistant (HR), Resistant (R), Moderately resistant (MR), Susceptible (S) and Highly susceptible (HS).

Screening of coriander genotypes/varieties

Thirty coriander genotypes/varieties were screened against *Fusarium oxysporum* f.sp. *corianderii* under sick plot conditions in field. The disease incidence was recorded using 1 to 9 rating scale. Based on disease reaction recorded, coriander genotypes/varieties were grouped into different categories i.e. Highly resistant (HR), Resistant (R), Moderately resistant (MR), Susceptible (S) and Highly susceptible (HS). Disease reaction was recorded by using standard rating scale (Iqbal *et al*. 2005) [4]. Four of the genotypes were resistant (R) *viz*, RCr-446, RCr-684. RCr-20 and RCr-41 While, nineteen genotypes *viz.,* RCr-475, RCr-480, RCr-728, UD-796, RD-366, UD-426, CO-3, UD-530, UD-743, UD-744, DH-246, NS-2, UD–728, UD-775, UD-630,UD-707, DH-208, RD-120 and RD-154 were categorized as moderately resistant (MR). Screenings of coriander genotypes/varieties against wilt disease were also done by Prakasam *et al.* (1987) [7]. Arora and Kant (2004) [1] screened twenty-five cumin cultivars for their resistance to blight and wilt diseases in natural conditions. Maximum resistance to wilt was shown by cultivars UC-220, EC-232684 and UC-63 and susceptibility was shown by cultivars RZ-19, UC-90, UC-231, JC-2000-72, CMB-134 and Jobner local. Out of 12 varieties of cumin, variety UC-310 showed maximum resistance to blight and UC-220 and UC-231 to wilt.

Champawat and Singh (2008) [2] identify resistant sources against *Fusarium oxysporum* f. sp. *cumini* and then to use them in resistance breeding programme. Though a few high yielding strains of cumin viz; S404, MC43, GC1, GC3 and RZ19 have been released in recent past but so for wilt resistant strains are not available because of limited variability in germplasm of cumin.

References

1. Arora DK, Kant U. Screening of cumin varieties for resistance against *Alternaria burnsii* and *Fusarium oxysporum* f. sp. *cumini*. Journal of Phytological Research. 2004; 17(1):85-87.
2. Champawat RS, Singh V. Seed spices, disease Management in Arid Land Crops, Scientific publishers Jodhpur (India), 2008; pp.197-232.
3. Dwivedi BP, Shukla DN. Effect of leaf extract of some medicinal plant on spore germination of some *fusarium* species. Karnataka Journal of Agriculture Sciences. 2000; 13:153-154.
4. Iqbal SM, Haq IU, Bukhari AG, Haqqani AM. Screening of chickpea genotypes for resistance against *Fusarium* wilt. *Mycopath.* 2005; 3(1-2):1-5.
5. Krishna De A. Spice: Some known and unknown facts. *Science and culture*. 1999; 65:220-228.
6. Manoranjitham SK, Rabindram R, Doraiswamy S. Management of seed borne pathogens and wilt disese of coriander. Madras Agricultural Journal. 2003; 90:4-6.
7. Prakasam V, PGB Vedamuthu, MAK, Jeyarajan R. Screening coriander lines for wilt resistance. S. Indian Hortic. 1987; 35:258-259.
8. Prasad N, Patel PN. *Fusarium* wilt of cumin in Gujarat state, Indian Plant Dis. Report. 1963; 47(6):528-531.
9. Ramaiah AK, Garampalli RKH. *In vitro* antifungal activity of some plant extracts against *Fusarium oxysporum* f. sp. *lycopersici.* Asian Journal of Plant Science and Research. 2015; 5(1):22-27.