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Short Communication

Impact of organic inputs on *Fusarium oxysporum* f. sp. c*iceris causing* wilt of chickpea

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Abstract

Organic enriched composts *viz.,* himcompost, vermicompost, farm yard manure, poultry manure and NADEP and organic formulations namely cow urine, beejamrit, panchgavya, tamarlassi, vermiwash and biosol were evaluated against Fusarium wilt of chickpea caused by *Fusarium oxysporum* f. sp. *ciceri*s under *in vitro* conditions. Among all the organic formulations, Panchgavya showed maximum mycelial inhibition of 92.22 per cent followed by Biosol i.e. 72.22 per cent at 10 per cent concentration against the pathogen whereas, Tamarlassi was found least effective with 15.56 per cent mycelial inhibition. The extracts of all five organic composts showed antifungal properties against the pathogen even at 5 per cent concentration. At 25 per cent concentration Himcompost yielded maximum mycelial inhibition of 71.11 per cent followed by Vermicompost i.e. 65.27 per cent against the pathogen whereas, NADEP was found least effective i.e. 44.17 per cent inhibition. Hence, Himcompost and Panchgavya can be used as soil amendment and seed dresser, respectively for eco-friendly management of Fusarium wilt of chickpea.

Key words: Organic inputs, *Fusarium oxysporum* f. sp. *ciceri*s, concentration, mycelial inhibition.

The research during the past two decades has showed that organic farming is one of the most important components of sustainable agriculture. It keeps the soil dynamic with living activities and in good health. This method is self sustained, self dominant and self dependent and self reliant as compared to chemical farming. The nutritional and microbial analysis of organic inputs shows the presence of different macro and micro nutrients and was found to be quite effective in increasing the productivity of crops and suppressing the growth of various plant pathogens by producing antibacterial and antifungal compounds (Oblio *et al.* 2012).

Chickpea (*Cicer arietinum* L.) is an important pulse crop of rabi season. It is a cheap source of protein (about 17-20%) compared to animal protein. Low yield of chickpea is attributed to its susceptibility to several biotic and abiotic stresses. Among the biotic stresses, wilt caused by *Fusarium oxysporum* f. sp. *ciceri* (Padwick) Mauto and K. Sato which is worldwide in distribution. The fungus is a primarily soil borne pathogen, however, few reports indicated that it can be transmitted through seeds. Early wilting causes more loss than late wilting, but seeds from late-wilted plants are lighter, rough and dull than those from healthy plants. In India annual yield loss due to Fusarium wilt were estimated from 10-100% depending on susceptible cultivars and agro-climatic conditions (Patil *et al.* 2015; Trapero-Casas and Jimenez-Diez1985).

This disease can be managed by using chemicals but the continuous and injudicious use of chemicals has toxic effects on non target organisms and can cause undesirable changes in the environment. On the other hand organic inputs *viz*., soil amendments and organic formulations can yield an ecofriendly and economic management module against soil borne pathogens. Therefore, the present study was carried out under *in vitro* conditions to evaluate the organic formulations and composts against *F. oxysporum* f. sp. *ciceris.*

All the laboratory experiments were conducted in the Department of Plant Pathology, CSKHPKV, Palampur. *F. oxysporum* f. sp. *ciceris* was isolated from stem and root portions of wilted chickpea plants collected from different chickpea growing areas and maintained on potato dextrose agar and incubated at 25±1°C temperature. The purification of *F. oxysporum* f. sp. *ciceris* was made through single hyphal tip

method (Dhingra and Sinclair 1985). The pure cultures were preserved at 4°C in the refrigerator for further studies. Five organic enriched composts *viz.,* Himcompost, Vermicompost, FYM, Poultry manure and NADEP were procured from Organic Farm of the university and evaluated against *F. oxysporum* f. sp. *ciceris in vitro* conditions through Poisoned Food Technique (Falck 1907).

Aqueous extract was prepared from 100 g fresh organic compost mixed by adding 100 ml of sterile distilled water. The extract was collected by filtration through Whatman No.1 filter paper and the filtrate obtained was used as 100 per cent stock solution. The antifungal behaviour of this extract was studied. Five concentrations of 5, 10, 15, 20 and 25 per cent were prepared from stock solution with Dilution Method. Double strength of these five test concentrations was added to poisoned PDA in Petri plates with three repeats (Falck 1907). All plates were inoculated with 5 mm mycelial discs of an advance variant of *F. oxysporum* f. sp. *ciceris* and incubated at 25± 1°C for seven days as the pathogen completely covered the control plates with mycelial growth. The observations for radial growth of pathogen in each replications of the treatment with respect to control were recorded to work out mycelial inhibition as per McKinney (1923) formula:

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

Similarly six organic formulation *viz.,* Cow urine, Beejamrit, Panchagavya, Vermiwash, Tamarlassi and Biosol were procured from Organic Farm of the university and evaluated against *F. oxysporum* f. sp. *ciceris under in vitro* conditions at 2, 4, 6, 8 and 10 per cent concentration through Poisoned Food Technique.

The extracts of almost all six organic formulations showed antifungal properties against the pathogen even at 6 per cent concentration. At 10 per cent concentration Panchagavya showed maximum mycelial inhibition of 92.22 per cent followed by Biosol i.e. 72.22 per cent against *F. oxysporum* f. sp. *ciceri*s whereas, Tamarlassi was found least effective with 15.56 per cent mycelial inhibition (Table 1). Antifungal activity of panchagavya was also investigated against three soil borne pathogens *Rhizoctonia solani* Kuhn, *Fusarium oxysporum* Schltdl, *Sclerotium rolfsii* Sacc associated with capsicum nurseries by poisoned food technique (Jandaik and Sharma 2016).

Fig.1. Chickpea plant showing wilt symptom

Table 1. *In vitro* evaluation of organic formulation against *F. oxysporum* f. sp. *ciceris*

Organic formulation	Mycelial growth (mm) at different concentrations (%)					Mycelial inhibition (%) at different concentrations (%)				
	2	4	6	8	10	2	4	6	8	10
Beejamrit	80.00	78.33	75.33	56.67	36.33	11.11	12.96	16.30	37.04	59.63
Biosol	50.33	48.00	42.00	37.00	25.00	44.07	46.67	53.33	58.89	72.22
Cow urine	55.00	52.67	46.00	35.00	32.00	38.89	41.48	48.89	61.11	64.44
Panchagavya	52.00	33.33	30.33	25.33	7.00	42.22	62.96	66.30	71.85	92.22
Tamarlassi	84.67	84.00	83.00	79.00	76.00	05.93	06.67	07.78	12.22	15.56
Vermiwash	55.00	52.67	47.33	45.67	35.00	38.89	41.48	47.41	49.26	61.11
Control	90	90	90	90	90	-	-		-	-
CD (P=0.05)	1.97	1.93	2.67	2.50	1.81					

Table 2. *In vitro* evaluation of organic composts against *F. oxysporum* f. sp. *ciceris*

Organic compost	Mycelial growth (mm) at different concentrations (%)					Mycelial inhibition (%) at different concentrations (%)				
	5	10	15	20	25	5	10	15	20	25
Vermicompost	61.50	52.50	47.75	46.00	31.25	31.67	41.67	46.94	48.89	65.27
Himcompost	44.00	38.50	35.50	31.00	26.00	51.11	57.22	60.56	65.56	71.11
FYM	45.00	42.50	39.50	38.25	33.50	50.00	52.78	56.11	57.50	62.78
NADEP	74.00	66.00	65.00	53.00	50.25	17.78	26.67	27.78	41.11	44.17
Poultry Manure	71.00	63.00	60.33	56.33	43.00	21.11	30.00	32.97	37.41	52.22
Control	90.00	90.00	90.00	90.00	90.00					
CD (P=0.05)	1.83	1.37	2.36	2.29	4.68					

Similarly, the extracts of all five organic composts showed antifungal properties against the pathogen even at 5 per cent concentration. At 25 per cent concentration Himcompost yielded maximum mycelial inhibition of 71.11 per cent followed by Vermicompost i.e. 65.27 per cent against *F. oxysporum* f. sp. *ciceris* whereas, NADEP was found least effective i.e. 44.17 per cent (Table 2). Various organic inputs have been reported to possess antifungal activity against soil borne pathogens. Earlier workers reported the antifungal activity of cow urine (Basak and Lee 2005) and cow dung (Ashlesha *et al.* 2009) against soil borne pathogens (*F. oxysporum* f. sp. *cucumerinum, F. solani* and *Rhizoictonia solani*). Nakasone *et al.* (1999) reported that aqueous extracts of Vermicompost and other organic compost showed inhibition of the mycelial growth of *Botrytis cinera*, *Sclerotinia sclerotiorum*, *Sclerotiorum rolfsii*, *Ralstonia solani*, and *F. oxysporum* f. sp. *lycopersici*. Chattopadhyay *et al.* (1999) reported that soil application of green manure, mustard cake and farm yard manure lead to significant reduction in population of *F. oxysporum* f. sp. *ciceri,* pathogen of chickpea wilt disease under field condition. Likewise, Joseph and Sankarganesh (2011) reported strong fungitoxic activity of panchgavya against different plant pathogenic fungus *viz*., *F. oxysporum, F. solani, Rhizopus oligosporus*.

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