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In vitro Evaluation of Antifungal Activities of Different Phytoextracts on Turmeric Anthracnose

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Abstract

Turmeric (Curcuma longa L.) (Family: Zingiberaceae) is an important spice crop, which is also called as “turmeric of commerce”. India is considered as the largest producer, consumer and exporter of turmeric in the globe. The plant suffers from anthracnose disease also called as leaf spot caused by Colletotrichum capsici. It was found increasing and occurring regularly every year and has become as a major constraint in successful cultivation of turmeric. It causes extensive yield and quality losses. It is necessary to manage the disease by non-chemicals which may provide valuable information which can be utilized for eco-friendly management of disease in future. Hence, in present investigation, various tests were conducted against the pathogen. This study was conducted to evaluate different phytoextracts under in vitro condition, as an eco-friendly means to control the disease. Nine locally available fresh healthy plant parts were collected and phytoextracts were separated for the experiment. The extracts were evaluated at 5, 10 and 15 per cent concentrations against C. capsici on the PDA using poisoned food technique under in vitro condition. The observations on growth in each treatment including control were taken and per cent inhibition was calculated based on difference in growth obtained in respective treatments and control. Among the nine various phytoextracts evaluated against C. capsici , the average highest per cent inhibition was observed in Lawsonia inermis L. (mehandi) which was significantly superior over Azadirachta indica (neem) and Ocimum sanctum L. (tulsi) which were significantly different with each other in inhibiting mycelium growth of C. capsici at all the three different concentrations tested.The study reports phytoextracts as potential and environment friendly means to control turmeric anthracnose disease. Mehandi, tulsi and neem were proved to be best. The damage caused by anthracnose disease is an issue of concern in turmeric cultivation. This study helps to understand the potential of phytoextracts against the disease. They shall be good alternatives to chemical pesticides as they are economic, target-specific and biodegradable.

Keywords: Curcuma Longa, Phytoextracts, Turmeric, Anthracnose, Colletotrichum Capsici

Introduction

Turmeric (Curcuma longa L.) is one of the most important spice crops cultivated in India. The crop yield is affected by several biotic and abiotic factors, among them, anthracnose of turmeric caused by Colletotrichum capsici was found increasing and occurring regularly every year. It has become as major constraint in successful cultivation of turmeric in Gujarat. Leaf spot disease of turmeric caused by C. capsici was reported for the first time from Coimbatore district of Madras by Mc Rae in 1917. Later, it was reported from turmeric growing regions like Cuddapah, Kurnool, Guntur, Krishna and Godavari districts of Andhra Pradesh and Coimbatore of Madras State (Ramakrishnan, 1954). Disease is soil-borne noticed on the leaves from July to October. In Gujarat, leaf spot of turmeric caused by C. gloeosporioides was first time reported by Patel et al. (2005). Leaf spot is the most important disease of turmeric resulting in losses of 25.83-62.12 per cent fresh weight and 42.10-62.10 per cent dry weight of rhizomes (Nair and Ramakrishnan, 1973). It causes extensive spotting of leaves (Plate 1.). The leaves may eventually dry and thus adversely affect the formation of rhizomes. The incidence of turmeric leaf spot caused by C. capsici reported 50 per cent yield loss (Ramakrishnan, 1954). It causes extensive yield and quality losses. It is necessary to manage the disease by non-chemicals which may provide valuable information which can be utilized for eco-friendly management of disease in future. Hence, in present investigation, different phytoextracts were tested against Colletotrichum capsici [1].

Materials and Methods

For growth inhibition of C. capsici the procedure given by Ansari (1995) was followed with a slight modification. Nine locally available fresh healthy plant parts of 100 g (leaves, rhizomes, cloves or bulbs) as indicated below in table (Table 1). Fresh leaves, rhizomes, cloves or bulbs of respective plants as shown in table (Table 1) were collected and first washed with tap water and then with sterilized water and air dried. Each sample was then homogenized in sterilized distilled water at the rate of 1 ml/g of tissues (1:1 V/W) with a mixer that is crushed in 100 ml of sterile water and filtered through fine muslin cloth. The filtrate was centrifuged at 5000 rpm for 20 minutes and the supernatant was filtered with fine muslin cloth, which formed the standard plant extract solution (100%). Five, ten and fifteen ml of stock solution was mixed with 95, 90 and 85 ml of sterilized molten PDA medium respectively to get 5, 10 and 15 per cent concentration. The medium was thoroughly shaken for uniform mixing of extract. The extracts were tested against C. capsici on the PDA using poisoned food technique under in vitro condition by pouring in 90 mm sterilized Petri plates keeping three replications for each concentration of extract. PDA without extracts was maintained as control. All the Petri plates were centrally inoculated with one week old four mm mycelium disc of the anthracnose pathogen and incubated at 28 ± 20 C. Seven days after incubation, the radial growth of mycelium was recorded and per cent inhibition of fungal growth for each treatment and concentration was calculated by using the formula given by Vincent (1947) [2].

Sr. No	Scientific name	Common name	Plant part used	Concentration (%)*		
				1	2	3
1	Allium sativum L.	Garlic	Cloves	5	10	15
2	Zingiber officinale Rosc.	Ginger	Rhizomes	5	10	15
3	Ocimum sanctum L.	Tulsi	Leaves	5	10	15
4	Lantana cameraL.	Lantana	Leaves	5	10	15
5	Jetropha curcas L.	Jatropha	Leaves	5	10	15
6	Adhatoda vasica Ness.	Ardusi	Leaves	5	10	15
7	Allium cepa L.	Onion	Bulbs	5	10	15
8	Azadirachta indica	Neem	Leaves	5	10	15
9	Lawsonia inermis L.	Mahandi	Leaves	5	10	15
10	Control		-			

Table 1: Different plant parts and their concentrations tested for mycelium growth inhibition.

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

Where,

I = Percent inhibition

C = Radial growth in control

T = Radial growth in treatment

Result and Discussion

Effect of nine different phytoextracts on the growth of test fungus was evaluated at 5, 10 and 15 per cent concentrations by poisoned food technique. The observations on growth in each treatment including control were taken and per cent inhibition was calculated based on difference in growth obtained in respective treatments and control. The data regarding per cent inhibition of the growth are presented in Table 2 and depicted in plate 1 [3].

The results presented in Table 2 revealed that all the phytoextracts moderately inhibited the growth of the pathogenic fungus as compared to the control. Per cent inhibition of the test pathogen with all plant extracts ranged from 2.24 to 20.16 at 5 per cent, 16.15 to 53.21 at 10 per cent and 21.17 to 77.52 at 15 per cent concentration, respectively. Maximum mean inhibition was obtained in mehandi (50.29 %) which was followed by neem (34.19 %) and tulsi (27.02 %). The rest of phytoextracts were also shown some effect and their mean per cent growth inhibitions were ginger (21.38 %), ardusi (17.27 %), garlic (17.06 %), lantana (16.10 %), jatropha (16.51 %) and onion (13.19 %) respectively. Toxicity index was highest in mehandi (150.89) and lowest in onion (39.56) based on maximum toxicity index of 300.00 [4].

Sr. No.	Phytoextract	Per cent inhibition*			Mean	Toxicity
		5%	10%	15%	(pooled)	Index#
1	Lawsonia inermis L.	26.68	46.84	61.7	45.07	150.89
	(Mehandi)	-20.16	-53.21	-77.52	-50.29	
2	Ocimum sanctum L.	14.8	19.34	52.86	29	81.05
	(Tulsi)	-6.53	-10.97	-63.55	-27.02	

3	Azadirachta indica	27.53	30.3	48.32	35.38	102.59
	(Neem)	-21.36	-25.45	-55.78	-34.19	
4	Zingiber officinale Rosc.	16.98	25.49	37.52	26.66	64.14
	(Ginger)	-8.52	-18.53	-37.09	-21.38	
5	Jetropha curcas L.	12.12	17.25	37.06	22.14	49.52
	(Jatropha)	-4.41	-8.79	-36.32	-16.51	
6	Allium sativum L.	13.52	20.62	35.25	23.13	51.17
	(Garlic)	-5.46	-12.4	-33.31	-17.06	
7	Adhatoda vasica Ness.	18.21	23.72	31.43	24.45	53.15
	(Ardusi)	-9.77	-16.19	-27.19	-17.72	
8	Lantana camera L.	13.49	27.02	28.14	22.88	48.31
	(Lantana)	-5.44	-20.63	-22.24	-16.1	
9	Allium cepa L.	8.6	23.7	27.39	19.89	39.56
	(Onion)	-2.24	-16.15	-21.17	-13.19	
	Mean	16.88 (8.43)	26.03 (19.26)	39.96 (41.25)	-	-
		Phytoextract (P)		Concentration (C)	P×C	
	S. Em. ±	0.2		0.11	0.34	
	C. D. at 5 %	0.56		0.32	0.96	
	C. V. %	2.13				

Table 2: In vitro evaluation of different phytoextracts on the growth inhibition of C. capsici

* Mean of three replications

Maximum toxicity index = 300.00

Data were arcsine transformed before analysis; values in parentheses are retransformed value.

Within phytoextracts, all three levels of phytoextracts significantly differed from each other. Higher concentrations of all the phytoextracts gave significantly more inhibition as compared to their lower level of concentrations. Among the nine phytoextracts tested, maximum inhibition of mycelium at 5 per cent was found in case of neem (21.36 %) followed by mehandi (20.16 %) and lowest mycelium inhibition was recorded in onion (2.24 %). Whereas the maximum inhibition of mycelium at 10 per cent was obtained in mehandi (53.21 %) followed by neem (25.45 %) and lowest mycelium inhibition was recorded in jatropha (8.79 %) [5].

Similarly, at 15 per cent, mehandi (77.52 %) followed by tulsi (63.55 %) and neem (55.78 %) showed significantly more inhibition over control. Mehandi, tulsi and neem were proved to be best and inhibited mycelium growth of test fungus at all the concentrations.

Similar results were also recorded by Shivapuri et al. (1997) noticed that among the plant extracts evaluated against C. capsici, Azadirachta indica Juss and Ocimum sanctum L. were more fungitoxic. Sinha et al. (2003) found that leaf extract of Ocimum sanctum L inhibited the radial growth of C. capsici by using poisoned food technique. Gawade (2007) reported that neem recorded highest mean inhibition (72.56 %) of mycelial growth of C. truncatum followed by the parthenium (61.31 %), mehandi (46.03 %) and bougainnveilia (28.98 %) [6].

Phytoextracts used as environment friendly means to control turmeric anthracnose disease. Hence in the present study nine various phytoextracts evaluated against C. capsici, the average highest per cent inhibition was observed in Lawsonia inermis L. (mehandi) which was significantly superior over Azadirachta indica (neem) and Ocimum sanctum L. (tulsi) which were significantly different with each other. Among the different concentrations tested, significantly highest per cent inhibition was recorded at 15 per cent concentrations of the botanicals.

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