



Survey and In vitro evaluation of botanicals against *Colletotrichum capsici* of Turmeric (*Curcuma longa* L.)

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Abstract:

Turmeric (*Curcuma longa* L.), a rhizomatous herbaceous monocot plant prone to many diseases. *Colletotrichum capsici* causing severe leaf spot foliar disease cause reduction in yield due to loss of photosynthetic area. *Colletotrichum* leaf spot was wide spread disease making its appearance in all the localities of Nizamabad district of Telangana. Maximum percent disease incidence was recorded in kondapoor village (52.50%) and the minimum incidence was recorded in Ankapoor (36.36%). Diseased leaf samples were collected for further study to know the efficacy of two botanicals viz, Iron weed & Marijuana at different concentrations (5%, 10%, 15%) on the radial growth of *Colletotrichum capsici* in PDA medium. The growth of pathogen was recorded at 48hrs and 72hrs after incubation. All the concentrations of two botanicals tested shows significantly reduced the radial growth of pathogen as compared to control. Among the two botanicals highest inhibition was observed with T2-Iron weed at 5% conc. (66.8% at 48hrs & 75.2% at 72hrs), at 10% conc. (73% at 48hrs & 80.2% at 72hrs) and at 15% conc. (80.9 at 48hrs & 86.7% at 72hrs) followed by T1-marijuana at 5% conc. (63.3% at 48 hrs & 73.5% at 72hrs), at 10% conc. (67.2% at 48hrs & 77.9% at 72hrs) and at 15% conc. (76.6% at 48hrs & 84.3% at 72hrs) after incubation respectively.

Keywords:

Turmeric, *Colletotrichum capsici*, Iron weed, Marijuana, leaf spot, radial growth, percent inhibition *etc.*,

Introduction:

Turmeric (*Curcuma longa* L.) is an ancient spice which is originated from India and South East Asia. It is a rhizomatous herbaceous perennial plant known as 'Indian saffron' as well as 'spice of life'. It is extensively cultivated in China, India, Indonesia, Thailand and throughout the tropics, including tropical regions of Africa and America (Herojit *et al.*, 2017). Turmeric is the third largest spice produced in the country accounts for about 14 % of total spices produced in India. It also has wide spectrum of biological and pharmacological activities including antioxidant, anti-inflammatory, hypoglycemic, antimicrobial, antiviral and anti-cancerous properties (Surega and Ramakrishna 2017). It is regarded as a symbol of well-being and future and is widely used in ceremonies and

religious functions. Turmeric contains essential oils up to 5% and curcumin up to 5%, a polyphenol (Pethe *et al.*, 2019). Major turmeric producing states in India are Telangana, Andhra Pradesh, Tamil Nadu, Karnataka, Orissa, West Bengal and Maharashtra. In Telangana during the year 2018-19, area covered under turmeric was 47888 hectares as against 44956 hectares in the corresponding period of last year. Among major turmeric growing districts, Nizamabad has reported 13965 hectares acreage under turmeric as against 12800 hectares in last year. Jagtial has so far reported 13250 hectares as against 12378 hectares during last year and Warangal (Rural) has reported 5521 hectares of acreage compared to last year's 4250 hectares. (Turmeric Outlook, March 2019). The important foliar disease on turmeric reported in Telangana is leaf spot caused by *Colletotrichum capsici* [(Syd.) Butler & Bisby]. Leaf spot is severe Nizamabad district of Telangana. Leaf spot appears when the crop is two months old (last week of August or 1st week of September) (Narasimha Rao *et al.*, 2012). The leaf spot caused by *C.capsici* resulted in drastic reduction in yield and quality of rhizomes of turmeric (Pethe *et al.*, 2019). Taking into consideration the importance of crop and seriousness of the leaf spot disease prevailing on turmeric, an experimental study was conducted against *C.capsici* by screening with botanicals & bioagents for the economical management of the disease (Kothikar and Koche, 2017).

Materials and Methods:

The present study was carried out in Laboratory, Dept. of Plant Pathology, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Naini, Prayagraj during 2019-20, to study the effect of botanicals against *Colletotrichum capsici*. A chronological survey was done in and around Nizamabad district of Telangana. Experimental studies were taken up using 5%, 10% & 15% concentrations of botanicals against radial growth of *Colletotrichum capsici*. The experiment was laid out in Completely Randomized Design (CRD) with 3 replications & three treatments.

Survey and collection of the disease samples

A randomised survey was carried out in and around Nizamabad district of Telangana for recording incidence of diseases of turmeric in farmer's field. Five different spots of 1m² were selected randomly over large area. The leaves of turmeric showing typical symptoms of leaf spot caused by *Colletotrichum capsici* were collected from farmer's fields and research plots, which were then properly marked, packed in polythene bags and brought to the laboratory for further studies.

Isolation and multiplication of *Colletotrichum capsici* from infected turmeric

Isolation of the pathogen was done by following the procedure of (Thilagam *et al.*, 2018). Infected leaf specimens collected from farmer's field during survey and experimental plot at central research field SHUATS, Prayagraj. The diseased leaf bits along with adjoining healthy portions were surface sterilized with 0.1% mercuric chloride (HgCl₂) solution for one minute and washed thrice with sterilized water taken in watch glasses to remove the traces if any. The diseased pieces were then dried by placing between two sterile filter papers, which were then transferred to sterilized petriplates containing solidified PDA medium in the laminar air flow chamber to avoid contamination. The inoculated petriplates were incubated at a temperature of 25±1°C and observed periodically for the growth of emerging fungus developed from diseased tissues. The hyphal growth of the fungus was then

transferred to PDA slants and petriplates and incubated at $25^{\circ}\text{C}\pm 1^{\circ}\text{C}$ and pure culture thus obtained through hyphal tip was maintained. Multiplication of pathogen was done by using potato dextrose agar media.



Fig: symptoms observed in Farmer's field during survey



Fig: Symptoms observed in experimental plot & Microscopic view of setae



Fig: pure culture of *C.capsici*

Efficacy of botanicals against *C.capsici* in vitro.

Two locally available botanicals viz. Marijuana (*Cannabis sativa*) and Iron weed (*Elephantopus scaber*) were assessed for their antifungal activities against *C.capsici* associated with leaf spot disease of turmeric at three levels of concentrations by Poisoned food technique. For preparation of aqueous plant extracts, hundred grams (100g) of leaves of botanicals namely Marijuana and Iron weed were collected and washed with distilled water and then air dried. Leaves were grinded at the ratio of 1:1 i.e 100gms of leaves in 100ml of distilled water. The mixtures were first filtered with muslin cloth, then with WhatMan No 1 filter paper and further centrifuged at 1500rpm for 20 minutes. The clean suspended solution was transformed into 100ml conical flask and then sterilized in autoclave at 15lbs pressure for 20 minutes and kept as stock solution. Further each botanical stock solution was used at three concentrations i.e 5%, 10% & 15%, were tested on the radial growth of *C.capsici* at 48hrs and 72hrs after incubation (Ruth et al., 2019).

The inhibition of radial growth was calculated by using formula

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

Where

C = Mycelium growth in control.

T = Mycelium growth in treatment.

Results and discussion:

Effect of botanicals against *C. capsici* in vitro:

The results (Table 1) indicated that efficacy was more at higher concentrations of botanicals. Amongst botanicals tested against the growth of pathogen, highest inhibition was observed with Iron weed at 5% conc. (66.8% at 48hrs & 75.2% at 72hrs), at 10% conc. (73% at 48hrs & 80.2% at 72hrs) and at 15% conc. (80.9 at 48hrs & 86.7% at 72hrs) followed by marijuana at 5% conc. (63.3% at 48hrs & 73.5% at 72hrs), at 10% conc. (67.2% at 48hrs & 77.9% at 72hrs) and at 15% conc. (76.6% at 48hrs & 84.3% at 72hrs) respectively over the control. All the concentrations of botanicals tested shows significantly reduced the radial growth of pathogen as compared to control.

Table 1: In vitro effect of botanicals at 5%, 10% & 15% conc. on radial growth(mm) & percent of inhibition (%) of *C.capsici* after 48hrs & 72hrs of inoculation.

Treatments	Mean of radial growth (mm) at 5% conc.		Mean of radial growth (mm) at 10% conc.		Mean of radial growth (mm) at 15% conc.		Mean of percent of inhibition % at 5% conc.		Mean of percent of inhibition % at 10% conc.		Mean of percent of inhibition % at 15% conc.	
	48hrs	72hrs	48hrs	72hrs	48hrs	72hrs	48hrs	72hrs	48hrs	72hrs	48hrs	72hrs
T0-Control	12.00	20.00	12.00	20.00	12.00	20.00	0.00	0.00	0.00	0.00	0.00	0.00
T1-Marijuana	4.33	5.26	3.86	4.40	2.73	3.10	63.33	73.53	67.26	77.90	76.66	84.33
T2-Iron weed	3.93	4.93	3.20	3.93	2.23	2.63	66.80	75.20	73.03	80.26	80.90	86.73
C.D.	2.42	2.45	2.42	2.42	2.36	2.72						
SE(m)	0.68	0.69	0.68	0.68	0.67	0.77						
SE(d)	0.97	0.98	0.97	0.97	0.94	1.09						

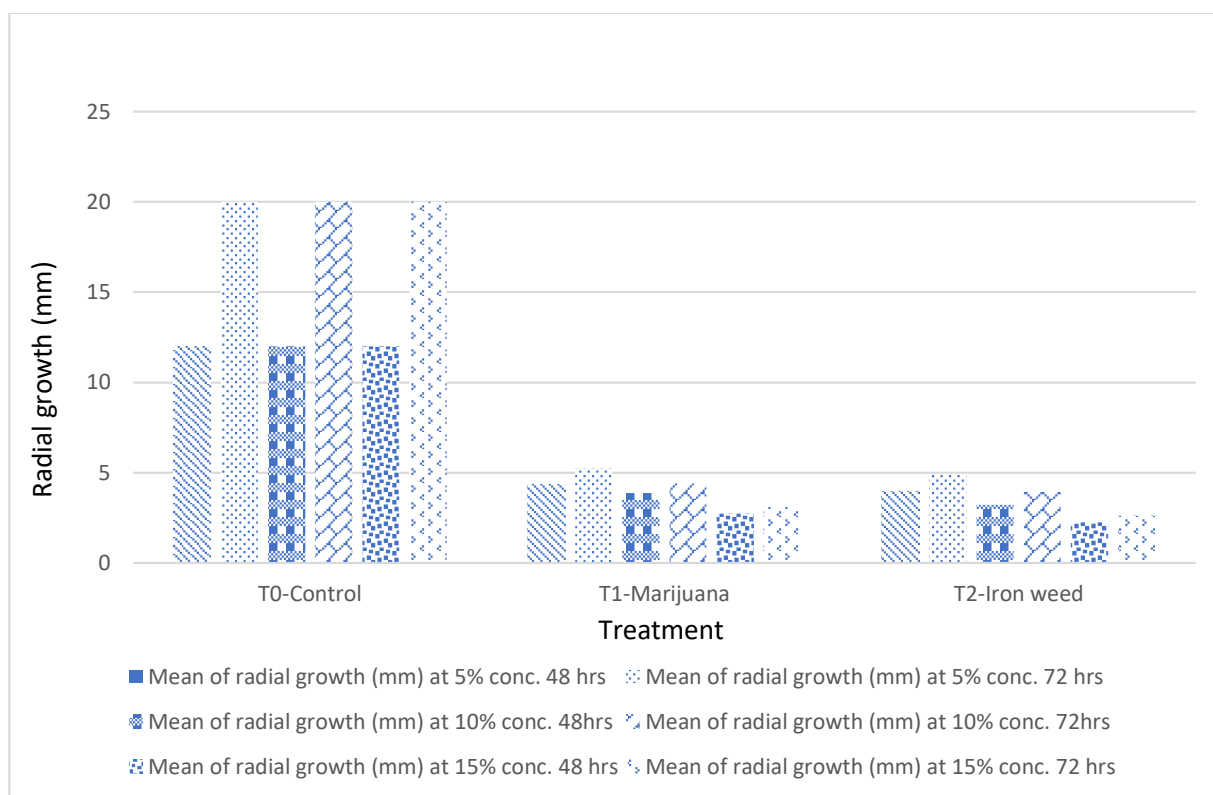


Fig: In vitro effect of botanicals at 5%, 10% & 15% conc. on radial growth(mm) of *C. capsici* after 48hrs & 72hrs of inoculation.

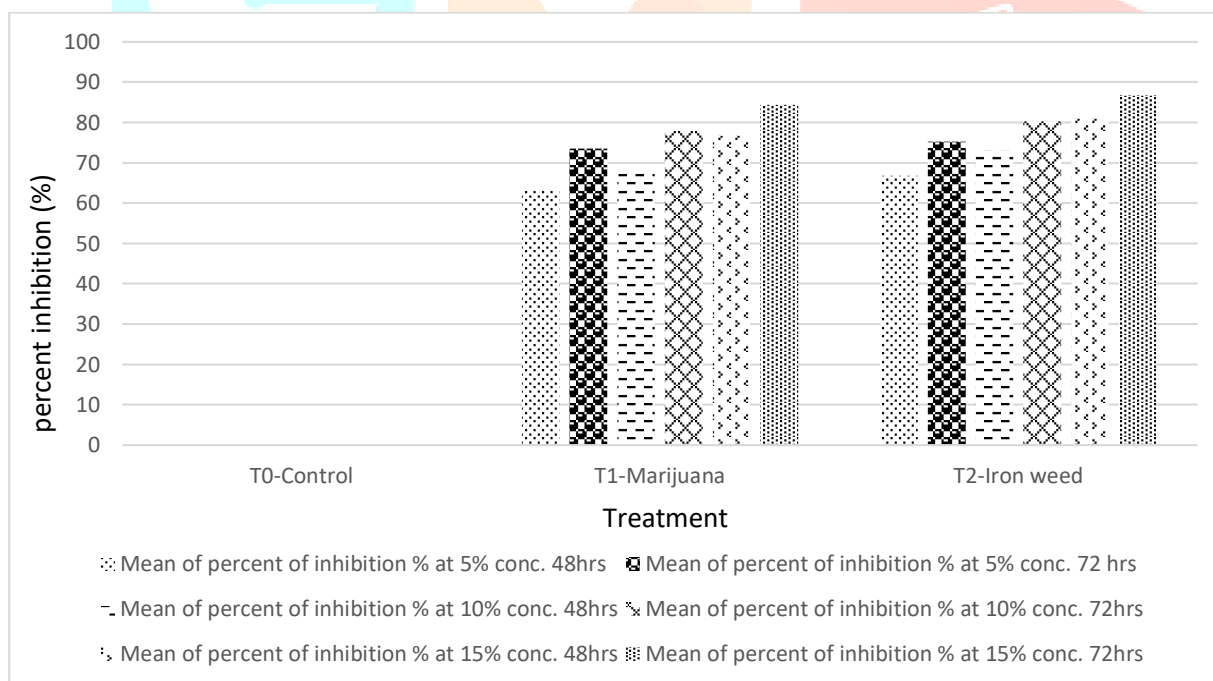


Fig: In vitro effect of botanicals at 5%, 10% & 15% conc. on percent inhibition of *C. capsici* after 48hrs & 72hrs of inoculation.

The results of the data presented in table-2 indicates that the Colletotrichum leaf spot was wide spread disease making its appearance in all the localities of Nizamabad district of Telangana. Maximum percent disease incidence was recorded in kondapoor village (52.50%), followed by Thimmapur (51.25%), Gandhari (48.61%), Medipally (46.83%), Gurjal (45.07%), Chedmal (42.85%) and with the minimum incidence recorded in Ankapoor (36.36%).

Table 2: Survey of Colletotrichum leaf spot of turmeric from different location of Nizamabad district, Telangana.

S.no	Name of the farmer	Location	Diseases notified	Mean of no. of infected leaves/5m ²	Mean of no. of healthy leaves/5m ²	Disease incidence
1	Dasarath	Medipally	Leaf spot	18.50	39.50	46.83
2	Dolathram	Thimmapur	Leaf spot	20.50	40.00	51.25
3	Prakash	Chedmal	Leaf spot/leaf blotch	15.00	35.00	42.85
4	Md Sohail	Ankapoor	Leaf spot	10.50	30.50	34.42
5	Mallaiah	Gandhari	Leaf spot	17.50	36.00	48.61
6	Ramesh	Gurjal	Leaf spot/leaf blotch	16.00	35.50	45.07
7	Shankar	Kondapoor	Leaf spot	21.00	40.00	52.50
8	Saidulu	Ankapoor	Leaf spot	14.00	38.50	36.36

Conclusion:

The present experimental study clearly indicates that Iron weed shows maximum inhibition of radial growth of *C.capsici* at 5%, 10% & 15% conc. at 48hrs & 72hrs of incubation respectively followed by Marijuana. The results indicate that botanicals show maximum inhibition over control. So, use of botanicals can be economical, long lasting and also free from harmful residual side effects. Observations recorded during survey in and around Nizamabad district of Telangana conclude that leaf spot disease is widely distributed disease due to favourable conditions.

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