

Isolation and *In vitro* evaluation of chemical Fungicides against *Fusarium solani* causing Wilt of Chilli

¹G.H. Sowmya, ²N. Rajeshwari and ²H.N. Ramesh Babu

^{1,2}Department of Botany and Seed Technology, Sahyadri Science College, Kuvempu University, Shivamogga-577203 (India)

Email: sowmyagyaralli95@gmail.com

Email: rajeshwaribabu02@gmail.com

Abstract

Wilt caused by *Fusarium solani* is one of the destructive diseases of Solanaceous plants and causes considerable loss in the yield and quality of the produce. An experiment was conducted to isolate and *in vitro* evaluation of different chemical fungicides at four different concentrations viz., 0.5%, 0.1% 0.15% and 0.2% against *Fusarium solani*. The study was carried out using poisoned food technique for chemical fungicides in Completely Randomized Design (CRD). Among all the chemical fungicide, Bavistin proved to be the most effective chemical fungicide recording 100% growth inhibition at all the tested concentrations and Mancozeb and SAAF (Carbendazim + Mancozeb) which also showed 100% inhibition in 0.15% and 0.2% concentration. Mancozeb at 0.05% concentration was least effective in reducing fungal growth (35%). This study indicated better performance of some chemical fungicides even at lower concentration. So, such effective fungicides could be used to minimize hazardous effect.

Chilli (*Capsicum annuum* L.) is one of the important commercial crops in India. It is one of the most important vegetable and spice crop belongs to family Solanaceae and genus *Capsicum*. Chilli is a tropical and subtropical crop, is one of the major vegetable and spice crops grown in the country and is popularly known as wonder spice, pepper and hot pepper⁷.

Chilli is cultivated both for green and red fruits having various culinary values. India is the leading country in production along with

China, Korea, Nigeria, U.S.S.R and Mexico. In India, Andhra Pradesh, Orissa, Maharashtra, West Bengal, Karnataka, Rajasthan and Tamil Nadu are the major producing states¹³. In India Chilli occupies an area of 840 thousand hectares with an annual production of 2096M.tonnes. In Karnataka green chilli occupies an area of 45.43 thousand hectares with production of 607.94 M tonnes.

It is susceptible to several diseases and pests, which become major constraints in its production. Among them the most

devastating are fungal diseases which lower the yield annually. One among the fungal diseases is Fusarium wilt, caused by the *Fusarium oxysporum* and *F. solani* were emerged as a serious problem in past decade. Leonian⁸ first time reported the wilt disease of chilli caused by *Fusarium* spp. *Fusarium oxysporum*, *F. solani*, *F. moniliforme* and *F. pallidoroseum* have been reported as the wilt causing agents from chilli growing areas but in India *F. oxysporum* and *F. solani* are the most prevalent species of *Fusarium* found associated with wilt disease of chilli¹¹.

This disease is distributed throughout the tropics and is very common in Karnataka. Wilt causes 10-50 percent crop losses around the world and 10-80 percent in India. The occurrence of the disease was first reported from New Mexico as early as 1919 as a rapid wilt. The wilt appears both in seedling and later stage but the highest mortality occurs at flowering and fruiting stage, as a result whole plant wilts leading to a complete loss. The plants exhibit symptoms such as leaf chlorosis, vascular discoloration and wilting of plants. Although the disease first appears in patches in a field, it can extend to the entire field if chilli is cultivated repeatedly in the same field loss. High temperature and high moisture were conducive to symptom development of wilt¹².

Among the fungal, bacterial and viral pathogens infecting chilli crop, wilt disease caused by *Fusarium solani* is emerging as a serious menace to chilli cultivation in India. It is infecting the crop at flowering stage and fruiting stage which leads to serious yield loss on chilli crop¹⁰. Research for finding the most appropriate and readily available fungicide with

least effective dose for controlling the disease is the current need. Hence the attempt was made to evaluate the most effective concentration of fungicide against the pathogen to manage the wilt disease.

Study site and sample collection :

Field survey was done in major chilli growing region of Chitradurga District during 2020-2021 to estimate the wilt disease of chilli. A purposive and randomized sampling method is used for survey and collection of samples¹⁵. Collection of infected material is performed with the pre-sterilized knife, forceps, cutter and other necessary accessories. The collected materials are carried in a presterilized polyethylene bag to the laboratory for the microscopic observation and identification.

Isolation and identification of the fungal pathogen :

The diseased specimen exhibiting wilt symptom was washed thoroughly in running tap water. A portion of the infected tissue along with adjacent small unaffected tissue were cut into small pieces (2-5mm) and they were transferred to sterile petridishes containing 1% Sodium hypo chlorite (NaOCl) solution for surface sterilization of plant tissue for 1 minute and washed repeatedly with sterile distilled water to remove disinfectants.

The sterilized pieces were aseptically transferred to Petridishes containing Potato Dextrose Agar (PDA) medium and incubated at room temperature (25±2°C) for 7-10 days. The culture plate showing the growth of the fungus was observed for the colony morphology and growth characteristics. Semi-permanent

Tabl-1. In vitro evaluation of fungicides against wilt disease of Chili

Sl. No.	Fungicide	Percent growth inhibition of <i>F. solani</i> at different concentration			
		0.05%	0.1%	0.15%	0.2%
1.	Mancozeb	35.93%	86.75%	100%	100%
2.	Bavistin	100%	100%	100%	100%
3.	Metalaxyl	70.31%	73.43%	78.12%	79.68%
4.	SAAF(Mancozeb+carbendazim)	85.93%	92.18%	100%	100%

mounts were prepared using lactophenol cotton blue and the slides were observed under microscope for the mycelial and spore bearing structures. Based on the observations, by comparing the standard work of Booth⁴, the identity of the fungus *Fusarium solani* was confirmed

In vitro inhibitory potential of fungicides against the pathogen :

Different concentrations of all the fungicides were tested for its *in vitro* inhibitory activity against *Fusarium solani* using poisoned food technique^{2,6,9}. Different concentration of prepared fungicide solutions were incorporated to the media and poured into petriplates separately for solidification. Next 5 mm mycelial discs of tested pathogen (seven day old) were taken and aseptically inoculated at the centre of the PDA plates. Simple PDA media plates devoid of fungicides served as control. Three replicates were used for each concentration of the fungicides. All the Plates were incubated at $25 \pm 2^\circ\text{C}$ for seven days and mycelial growth of the pathogen was recorded and percent inhibition of mycelial growth was calculated using the formula given by Vincent¹⁴.

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

Where,

I is the percent inhibition,

C is the colony diameter in control and

T is the colony diameter in treatment.

The four chemical fungicides were treated with four different concentrations (0.05%, 0.1%, 0.15% and 0.2%) against *Fusarium solani*. All the four concentrations of used fungicides showed significant percent inhibition of mycelial growth as compared to control. Among all the chemical fungicide, Bavistin proved to be the most effective chemical fungicide recording 100% growth inhibition at all the tested concentrations. Mancozeb and SAAF (Carbendazim + Mancozeb) which also showed 100% inhibition in 0.15% and 0.2% concentration. Mancozeb at 0.05% concentration was least effective in reducing fungal growth (35.93%). But Metalaxyl showed percentage of inhibition increased with increase in the concentration. It showed from 70.31% to 79.68% inhibition in 0.05% and 0.2% respectively. Choulwar *et al.*, in 1989 reported that Mancozeb was active in inhibiting the colony growth of *Alternaria*

solani at 0.2% concentration and improved resistance in controlling early blight disease of tomato caused by *A. solani*. According to Dahal and Shrestha 2018, Carbendazim in all concentration (100ppm, 150ppm and 200ppm) showed 100% inhibition of *F. oxysporum* but Chlorothalonil and DM-45 increased with increase in the concentration. Bhaliya and Jadeja³ recorded Mancozeb and Zineb gave 100% inhibition of *F. solani* at all the concentration, while chlorothalonil and copper oxychloride gave 80.28% and 79.25% inhibition respectively in 2500ppm.

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