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## *In vitro* evaluation of different Phyto-extracts against *Fusarium oxysporum* f. sp. *cubense* causing Panama wilt disease in Banana

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**Abstract**

Banana is one of the most important and widely consumed fruit crop in the world. Out of several diseases Panama wilt caused by *Fusarium oxysporum* f. sp. *cubense* (Foc) is one of the most important limiting factor which reduces the potential yield of the crop. To offer an attractive and environmentally sound alternative for the control of Fusarium wilt of banana as chemicals pose threat to environment, efficacy of botanicals against Foc was analysed *in-vitro*. Among fourteen different plant products tested in two different concentrations 15% and 20%, leaf extracts of Guava and deodar were found to be best in 15% concentration and reduced 83.6% and 80.9% radial growth of the causal pathogen followed by Allamanda leaves with 78.2% control. In 20% Kochilla leaf extract showed highest 87.9% radial growth inhibition of Foc followed by Mahaneem leaves and garlic bulb with 86.1% and 85.7% growth inhibition respectively.

**Keywords:** Panama wilt, botanicals

**Introduction**

Banana (*Musa* sp.) is one of the oldest fruits known to mankind. It is considered as the fourth most widely consumed food crop in the world after rice, wheat and corn based on gross value. While banana has a tremendous potential as cash and export commodity for most banana growing countries, diseases and pests constitute major limiting factor for increasing its production. Global banana production is seriously threatened by the emergence of a Fusarium Wilt, caused by the soil-borne fungi *Fusarium oxysporum* f. sp. *cubense* (Foc) as inoculum survives in soil as clamydospores and offer difficulty in managing the disease. Employing drenching chemical fungicides to soil leaves residues and pose serious threat to soil health. Hence alternate methods has to be taken up to manage panama wilt which is ecofriendly and pollution free. The present investigation was taken up to evaluate efficiency of botanical extracts in managing Foc *in-vitro* to offer an attractive and environmentally sound alternative for the control of Fusarium wilt of banana.

**Materials and Method**

**Preparation of cold aqueous extract:** Fresh plant leaves were collected and washed first in tap water and then in distilled water. Hundred grams of fresh sample was chopped and then crushed in a surface sterilized pestle and mortar by adding 100 ml sterile water (1:1 w/v) to get hundred per cent concentration. The extract was filtered through two layer of muslin cloth. Finally filtrate thus obtained was used as stock solution.

**Effect of botanicals on mycelial growth of *Fusarium oxysporum* f. sp. *cubense***

To study the antifungal mechanism of plant extract, the poisoned food technique was used (Nene and Thapliyal, 1982). Five ml, ten ml and fifteen ml of stock solutions were mixed with 95, 90 and 85 ml of sterilized molten PDA media, respectively so as to get 5, 10 and 15 per cent concentration. The medium was thoroughly shaken for uniform mixing of extract and sterilized by autoclaving at 0.733 kg/cm<sup>2</sup> (10 psi) pressures for 15 min. After sterilization Streptomycin sulphate at the rate of 250 mg was added per litre of media. Twenty ml of poisoned medium was poured into each of the 90 mm sterile petriplates. Each plate was inoculated with five mm mycelial discs from periphery of actively growing zone of ten days old culture were cut out with cork borer and one such disc was placed at the centre of each agar plate. Controls were also maintained by growing the pathogen on PDA plates. Then such plates were incubated at 27 ± 1 °C temperature for ten days and radial growth was taken when maximum growth was occurred in the control plates.

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

**Where**

I = Per cent inhibition

C = Radial growth in control

T = Radial growth in treatment

Further, angular transformations were made for data and analysed statistically.

**Result and Discussion****Effect of various Plant products in reducing the radial growth of *Fusarium oxysporum f.sp cubense*(Foc)**

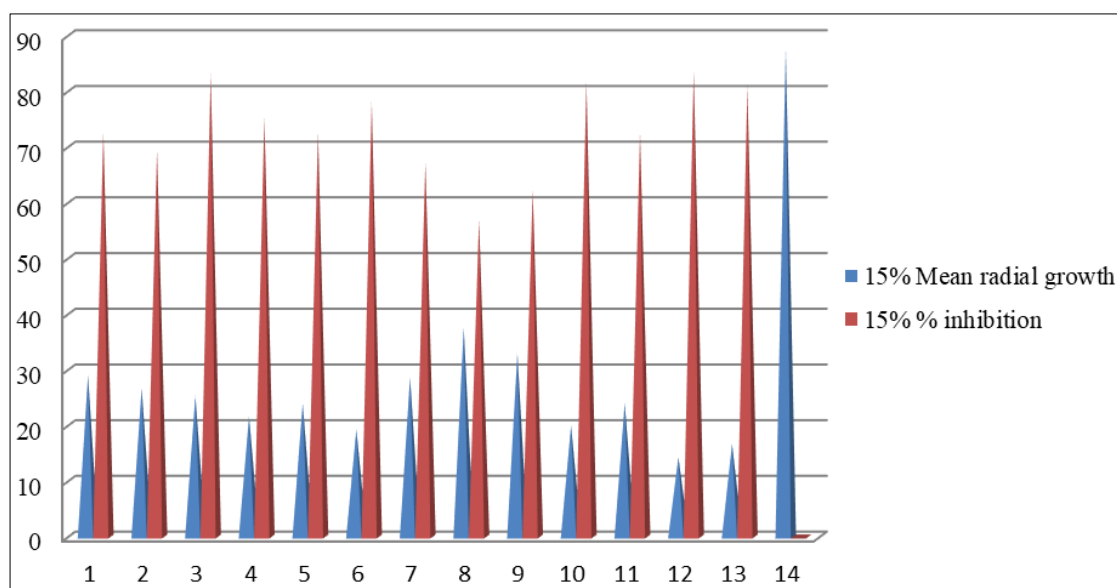
Fourteen different plant products were tested for their efficacy against *Fusarium oxysporum f. sp. cubense* (Foc) including control in two different concentrations 15% and 20%. Effect of plant product in two different concentration was conducted *in vitro* condition and data was presented in Table 1. Significant difference was observed among all plant extract in reducing radial growth of Foc in comparison to control in both 15% and 20% concentration. Guava leaves, Deodar leaves

were found to be best in 15% concentration and reduced 83.6% and 80.9% radial growth respectively. These Two plant extract were significantly different from others. Allamanda leaves were next best with 78.2% growth reduction of radial growth and 19.3 mm radial growth as compared to control (87.7 mm). Allamanda leaves, Drumstick leaves and Mahaneem leaves extract proved equal at par in reducing radial growth of Foc. Among all plant extract used Doob leaves extract recorded least percentage inhibition (57%) against Foc in 15% concentration.

In 20% concentration the plant extract showed nearly similar trend in reducing radial growth of Foc, with kochilla leaves extract showing highest (87.9%) radial growth inhibition of Foc followed by Mahaneem leaves (86.1%) and Garlic bulb extract (85.7%). Other plant extracts were also found to be significantly different from each other and in comparison to the control with percentage inhibition ranging from 70.3%-79.3%. Plant extract of Neem leaves Tulsi, Mahaneem, Marigold, Garlic bulb, Kochilla leaves and Guava leaves proved significantly better among all the plant extract used and reduced more than 80% of the radial growth of causal organism (Table, Figure).

**Table 1:** Effect of various plant products against radial growth of *Fusarium oxysporum f.sp cubense*.

Treatment	Plant extracts	Plant part used	Mean radial growth(mm)			
			Concentration			
			15%		20%	
			Mean radial growth	% inhibition	Mean radial growth	% inhibition
T1	Gangasiuli	Leaves	29	72.6	24	67.2
T2	Tulsi	Leaves	26.7	69.5	17.6	80.1
T3	Neem	Leaves	25.3	83.2	14.7	71.4
T4	Mahaneem	Leaves	21.6	75.3	12.3	86.1
T5	Basanga	Leaves	24	72.6	26.3	70.3
T6	Allamanda	Leaves	19.3	78.2	20.3	77.1
T7	Marigold	Leaves	28.6	67.3	16.3	81.6
T8	Doob	Leaves	37.6	57	29	67.2
T9	Garlic	Bulb	33	62.3	12.6	85.7
T10	Drumstick	Leaves	20	81.7	16	77.4
T11	Kochilla	leaves	24	72.6	10.7	87.9
T12	Guava	Leaves	14.3	83.6	14	84.1
T13	Deodar	Leaves	16.7	80.9	18.3	79.3
T14	Control	-	87.7	0	88.7	0
SEm ±			1.179		1.076	
CD at 5%			3.432		3.134	

**Fig 1:** Effect of plant products (15% concentration) against *Fusarium oxysporum f. sp. cubense* *in vitro*

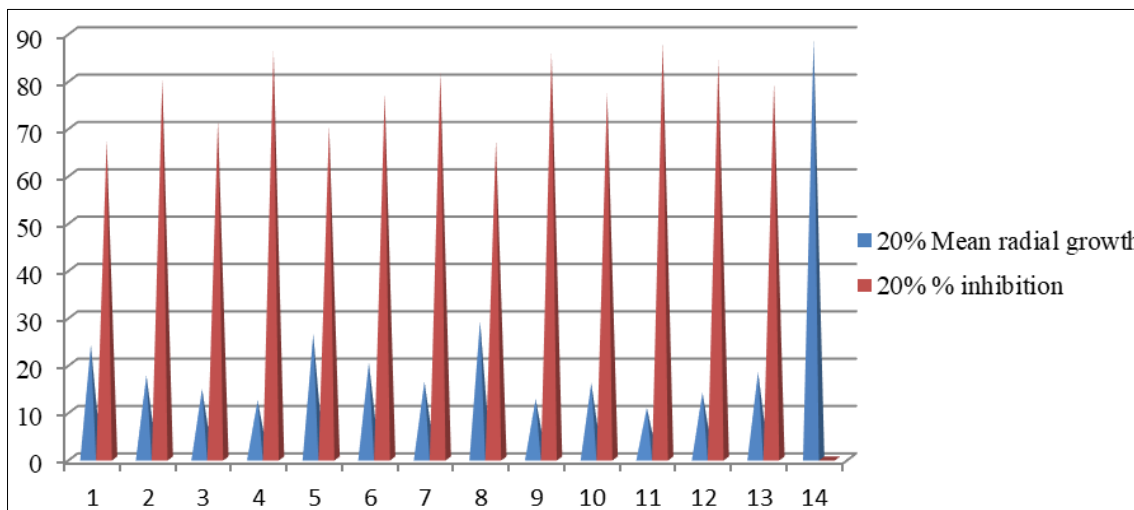


Fig 2: Effect of plant products (20% concentration) against *Fusarium oxysporum f. sp. cubense* in vitro

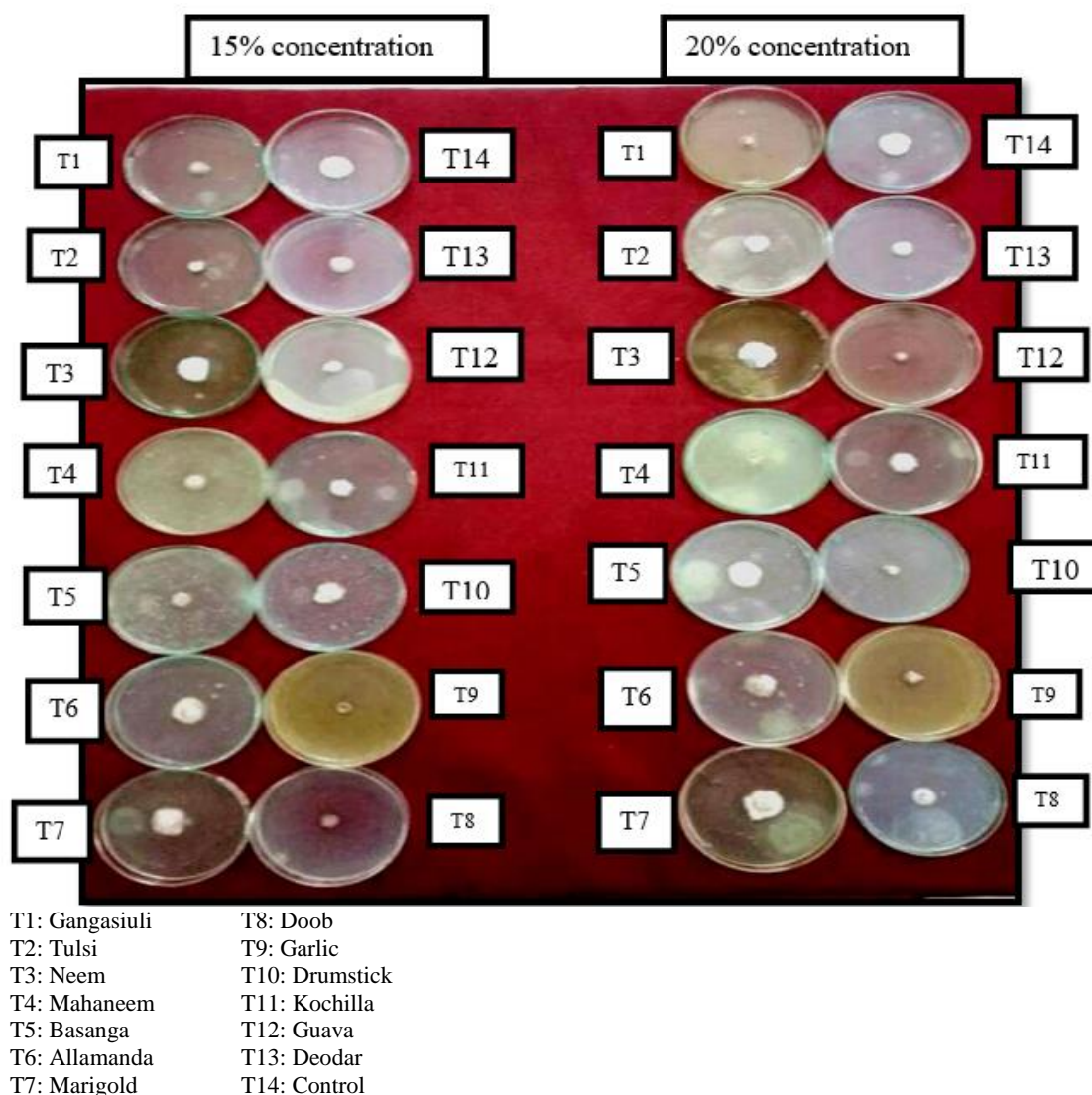


Fig 3: Effect of various plant products against radial growth of *Fusarium oxysporum f. sp. cubense*.

**Conclusion**

Leaf extracts of Guava and deodar were found to be best in 15% concentration and reduced 83.6% and 80.9% radial growth of the causal pathogen followed by Allamanda leaves with 78.2% control. In 20% Kochilla leaf extract showed highest 87.9% radial growth inhibition of *Fusarium oxysporum f. sp. cubense* (Foc) followed by Mahaneem leaves and garlic bulb with 86.1% and 85.7% growth inhibition

respectively. Leaf extract of tulsi, mahaneem, marigold, garlic bulb, kochilla leaves and guava inhibited more than 80% radial growth of causal pathogens.

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