



# In Vitro Determination of Efficacy of Contaf on the Mycelial Growth of *Fusarium Solani*, *Curvularia Clavata* and *Trichoderma Aureoviride*

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Received 2<sup>nd</sup> October 2014, revised 8<sup>th</sup> November 2014, accepted 2<sup>nd</sup> December July 2014

## Abstract

*In vitro* efficacy of the systemic fungicide Contaf (Hexaconazole 5 EC) was evaluated at different concentrations i.e., 50, 100, 150, 200 ppm against the fungi *Fusarium solani*, *Curvularia clavata* and *Trichoderma aureoviride*. Increase in the concentration of fungicide lead to the decrease in the mycelial growth of the fungi. At 200 ppm concentration, all the fungi showed drastic growth inhibition. The maximum growth inhibition was showed by *Curvularia clavata* followed by *Trichoderma aureoviride* and *Fusarium solani*.

**Keywords:** Systemic fungicide, *Fusarium solani*, *Curvularia clavata*, *Trichoderma aureoviride*.

## Introduction

Population increase in multiples of millions across the globe every year is posing a challenge to the scientists and policy makers in meeting the demand for food, fuel and as well as for providing better living conditions. Food production receded further due to the shift in crop pattern towards bio fuel plants in some countries. Scarcity of cultivable land due to over population has lead to the use of pesticides in agriculture, to cope up with the growing food demand. Crop production may be improved conventionally through increasing cultivated land, multiple crops, improved crop varieties supported by the use of fertilizers and pesticides. A number of factors such as insect pests, diseases, weeds, rodents etc. affect the crop yield. Pests and diseases cause one third loss to all global agricultural production every year<sup>1</sup>. Of which, nearly 20% loss is due to pathogenic fungal diseases<sup>2</sup>. Pesticides play an important role in agriculture by protecting the crops and increasing the yield. Research studies also support the recommended use of pesticides for increase in productivity. There is a considerable economic loss, without the use of pesticides and the significant increase in crop yield can be quantified by the use of pesticides<sup>3</sup>. Among the South Asian countries, India is the largest consumer of pesticides, with a maximum consumption of 44.5% of the total pesticides by cotton crop<sup>4</sup>. Systemic fungicides are effective against fungal diseases such as powdery mildews and leaf spots. Among them, Triazoles constitute an important group of fungicides. Contaf is a systemic fungicide used extensively on a wide variety of vegetable crops like chillies, tomato, carrot, onion besides certain important fruit orchards like grapes. It consists of pure active ingredient hexaconazole. Therefore, the present study was conducted, to evaluate the efficacy of systemic fungicide Contaf on the radial mycelial growth of *Fusarium solani*, *Curvularia clavata* and *Trichoderma aureoviride* *in vitro*.

## Material and Methods

**Isolation of test fungi:** The test fungi were isolated from the fields of Shamshabad, Shankarapally, Chevella of Telangana state, India. The isolated fungi were grown on Czapek's dox agar (CDA) medium. After 7 days of incubation, from the fungal colonies, pure cultures are maintained on CDA slants.

**In vitro evaluation of fungicide on the growth of fungi:** In the present study, the systemic fungicide Contaf at different concentrations *viz.*, 50, 100, 150 and 200 ppm were tested against *F. solani*, *C. clavata* and *T. aureoviride* by poisoned food technique<sup>5, 6</sup>. A known concentration of the fungicide was added to each 100 ml of autoclaved Czapek's dox agar medium. 20 ml of the media was poured into each sterilized Petri plate. The media without fungicide served as control. After solidification of the media in the Petri plates, 5mm mycelial disc was cut from the margin of actively growing colony and placed in the centre of each Petri plate. Triplicates were used for each treatment. The Petri Plates are incubated at  $25 \pm 20^{\circ}$  C and the diameter of the mycelial growth was measured after 10 days. The radial growth of the mycelium was recorded and the percent growth inhibition was calculated using the formula<sup>7</sup>,  
 $I=100X (C-T)/C$

I=Percent mycelial growth inhibition C= Radial growth of fungus in control (mm). T=Radial growth of fungus in treatment (mm)

## Results and Discussion

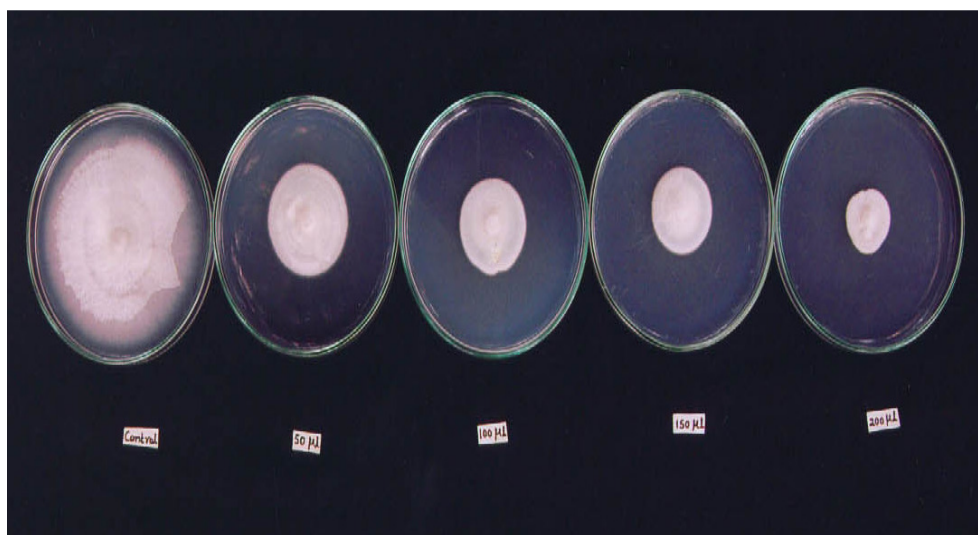
In the study conducted, the systemic fungicide Contaf was evaluated for their effect on the mycelial growth of *F. solani*, *C. clavata*, *T. aureoviride*. Results obtained on the fungitoxicity of contaf against the three fungi *in vitro* are presented in Table -1 and also observed in figure-1, 2, 3. The radial mycelial growth

of the fungi was recorded after 10 days of incubation. The mycelial growth of the fungi declined over the control. It was found that the increase in the concentration of contaf gradually decreased the radial growth of the fungi. A perusal of data revealed that Contaf (Hexaconazole 5 EC) effectively inhibited the radial growth of *F. solani*, *C. clavata*, *T. aureoviride*. Mycelial growth of the fungi differed significantly at various concentrations. The growth inhibition was maximum at 200 ppm. Mycelial growth was least for *C. clavata* (9mm) followed

by *T. aureoviride* (14mm) and *F. solani* (24mm) at 200 ppm concentration. The efficacy of the fungicide is determined by the percentage inhibition of the mycelial growth. The percentage inhibition was 88% for *C. clavata*, 80% for *T. aureoviride* and 70% for *F. solani* at 200 ppm concentration of the fungicide. Thus, Contaf showed a detrimental effect on the *in vitro* growth of the three pathogenic fungi. A suppressive effect was displayed by the fungicide and the colony growth decreased with increase in concentration of fungicide treatment.

**Table-1**  
**Effect of different concentrations of the fungicide on the mycelial growth (in mm) of *Fusarium solani*, *Curvularia clavata* and *Trichoderma aureoviride***

Trade name and Active substance	Chemical group	Species of fungi	Concentration (ppm)	Colony diameter in (mm)	% of growth inhibition
Contaf and Hexaconazole	Triazole	<i>Fusarium solani</i>	Control	81	00.00
			50	38	53.08
			100	33	59.25
			150	31	61.72
			200	24	70.37
		<i>Curvularia clavata</i>	Control	75	00.00
			50	24	68.00
			100	14	81.33
			150	12	84.00
			200	09	88.00
		<i>Trichoderma aureoviride</i>	Control	73	00.00
			50	34	53.42
			100	21	71.23
			150	19	73.97
			200	14	80.82



**Figure-1**  
 Effect of contaf (Hexaconazole 5 EC) on the growth of *Fusarium solani* Extreme left: Control plate, Right: Test Plates

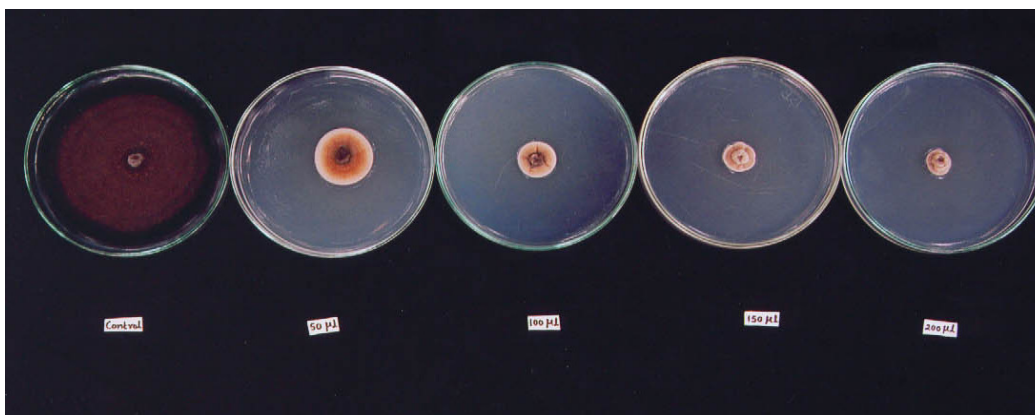


Figure-2

Effect of contaf (Hexaconazole 5 EC) on the growth of *Curvularia clavata* Extreme left: Control plate, Right: Test Plates

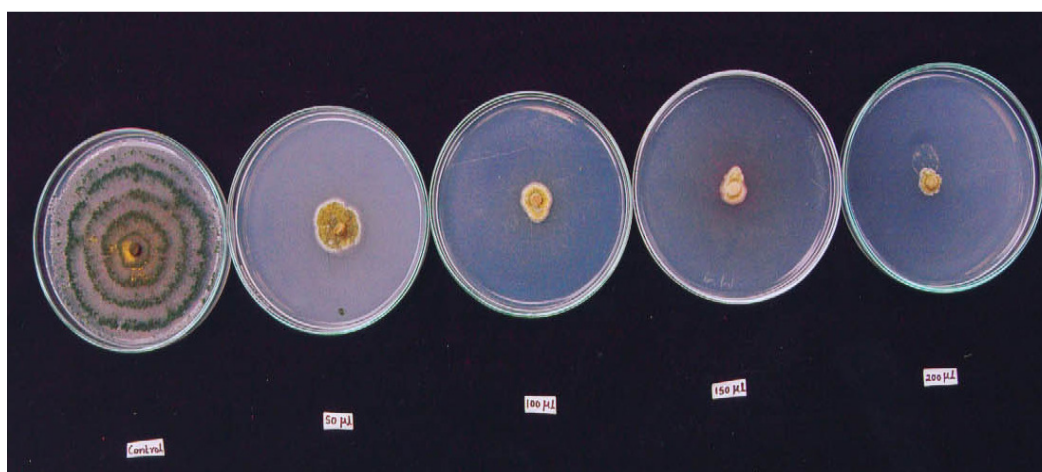


Figure-3

Effect of contaf (Hexaconazole 5 EC) on the growth of *Trichoderma aureoviride* Extreme left: Control plate, Right: Test Plates

There are several reports on the efficacy of fungicides that inhibit the growth of pathogen in *in vitro* condition. Similar findings that supported our study, Hexaconazole was proved to be highly toxic compared to the fungicides viz., carbendazim, propiconazole in inhibition of the growth of *T. harzianum*<sup>8</sup>. Among the systemic fungicides used, hexaconazole was found effective in inhibiting the mycelial growth and spore germination of *Fusarium oxysporum*, followed by carbendazim, bitertanol, myclobutanil<sup>9</sup>. Fungicides containing triazoles as active ingredients are considered as the most effective plant protection agents against *Fusarium* species<sup>10</sup>.

The present work is also supported by the findings that Carbendazim, propiconazole, chlorothalonil and hexaconazole retards the growth of fungus *Metarhizium anisopliae*<sup>11</sup>. Hexaconazole compared to Propiconazole and triflumizole is highly toxic and inhibits the growth of *Trichoderma harzianum*<sup>12</sup>. The systemic fungicide hexaconazole is effective in inhibiting the growth of *Fomeslamoensis* (the brown root rot pathogen of tea plant) followed by propiconazole, Bavistin, roko

and ektino<sup>13</sup>. *In vitro* screening had proved hexaconazole as a superior systemic fungicide to carbendazim and thiophanate methyl in inhibiting the growth of *Elsinoe ampelina*<sup>14</sup>. Mycelial growth of *Fusarium solani* was inhibited by Baynate, Blitox 50, Captan, Carbendazim, Contaf and Indofil M-45<sup>15</sup>. The efficacy of fungicides viz., Carboxin, Epoxiconazole, Hexaconazole, Propiconazole and Triadimetox are highly effective against *Rhizoctonia solani*, *Sclerotium rolfsii*<sup>16</sup>. Benlate and Captan showed inhibition of mycelial growth and spore formation of *Alternaria alternata*, *Cochliobolus sativus*, *F. moniliforme*, *F. oxysporum* and *Drechslera halode*<sup>17,18</sup>. Benomyl showed effective control on the growth of *Fusarium moniliforme* and *Fusarium oxysporum*<sup>19,20</sup>. Observations on the radial growth of *Trichoderma harzianum* and *Trichoderma virens* indicated that carbendazim, benomyl, carboxin, propiconazole, hexaconazole, tricyclozole, tridemorph, chlorothalonil showed 100% growth inhibition<sup>21</sup>. *In vitro* evaluation of the mycelial growth of *Curvularia lunata* revealed maximum growth inhibition by systemic fungicides viz., difenoconazole and propiconazole<sup>22</sup>. Among the systemic fungicides, Carbendazim recorded highest

inhibition of mycelial growth of *Fusarium solani* followed by Benomyl, Thiophanate methyl and Triademifon<sup>23</sup>. The fungicides Carbendazim, Hexaconazole, Thiophanate methyl, Triademifon, Metalaxyl, Mancozeb, Captan, Copper oxychloride and Chlorothalonil were evaluated for their efficacy against *Fusarium oxysporum* f. sp. *pini*. The maximum inhibition was shown by Carbendazim followed by others among systemic fungicides and Mancozeb showed the maximum inhibition among non-systemic fungicides<sup>24</sup>. *In vitro* evaluation of seven fungicides viz., Tetraconazole, Tebuconazole, captan, Mancozeb, Carbendazim, Sulphur and copper, Carbendazim and Mancozeb against *Corticium theae* revealed Tetraconazole as the most effective followed by Tebuconazole in suppressing the radial growth of the pathogen<sup>25</sup>. The efficacy of fungicides viz., Carbendazim, Captan, Copper oxychloride, Mancozeb and Ridomil MZ- 72 against *Phomopsis vexans* showed complete inhibition of mycelial growth by Carbendazim followed by other fungicides<sup>26</sup>.

## Conclusion

It is revealed from the present study, that the systemic fungicide contaf inhibited the mycelial growth of *F. solani*, *C. clavata* and *T. aureoviride*. *C. clavata* was found to be more sensitive to the fungicide, than the other two species. *In vitro* studies should be complemented with field trials to prove or disprove the effectiveness of the fungicide. The objective of the present study, was to evaluate the efficacy of the fungicide contaf under laboratory conditions for its final use in the field trial.

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