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Vibhute SM

M.Sc. Department of Plant Pathology,
College of agriculture, Dr. Balasaheb
Sawant Konkani Krishi Vidyapeeth,
Dapoli, Ratnagiri, Maharashtra, India

Rathod RR

Assistant Professor, Department of
Plant Pathology, College of
Horticulture, Mulde, Dr. Balasaheb
Sawant Konkani Krishi Vidyapeeth,
Dapoli, Ratnagiri, Maharashtra, India

Bhagwat RG

Associate Professor, Department of
Plant Pathology, College of agriculture,
Dr. Balasaheb Sawant Konkani Krishi
Vidyapeeth, Dapoli, Ratnagiri,
Maharashtra, India

Palshetkar MG

Assistant Professor, Department of
Agril. Botany, College of agriculture,
Dr. Balasaheb Sawant Konkani Krishi
Vidyapeeth, Dapoli, Ratnagiri,
Maharashtra, India

Thokal RT

Professor and Head, Department of
Irrigation and Drainage Engineering,
College of Agril Engg and Technology,
Dapoli and Chief Scientist, AICRP-
IWM, Maharashtra, India

Joshi MS

Head, Professor and Associated Dean,
Department of Plant Pathology, College
of Agriculture, Dr. Balasaheb Sawant
Konkani Krishi Vidyapeeth, Dapoli,
Ratnagiri, Maharashtra, India

Parbhane DV

M.Sc. Department of Plant Pathology,
College of agriculture, Dr. Balasaheb
Sawant Konkani Krishi Vidyapeeth,
Dapoli, Ratnagiri, Maharashtra, India

Babhare SV

Ph.D. Agri., Department of Plant
Pathology, College of Agriculture, Dr.
Balasaheb Sawant Konkani Krishi
Vidyapeeth, Dapoli, Ratnagiri,
Maharashtra, India

Corresponding Author:

Vibhute SM

M.Sc. Department of Plant Pathology,
College of agriculture, Dr. Balasaheb
Sawant Konkani Krishi Vidyapeeth,
Dapoli, Ratnagiri, Maharashtra, India

In vitro efficacy of different fungicides and organics against guava anthracnose caused by *Colletotrichum gloeosporioides*

Vibhute SM, Rathod RR, Bhagwat RG, Palshetkar MG, Thokal RT, Joshi MS, Parbhane DV and Babhare SV

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Abstract

The anthracnose disease caused by *Colletotrichum gloeosporioides* is second most common and serious disease of guava, which significantly decreased the market value of fruits. In present research work, eight fungicides (systemic, non-systemic and combi product) viz., Carbendazim 12% + Mancozeb 63% WP, Metalaxyl 4% + Mancozeb 64% WP, Iprovalicarb 5.5% + Propineb 61.25% WP, Tebuconazole 50% + Trifloxystrobin 25% WG, Azoxystrobin 23% SC, Carbendazim 50% WP, Thiophanate methyl 70% WP, Difenconazole 25% EC at two different concentrations and extract of six plant species viz., *Lantana camara*, *Zingiber officinale*, *Azadirachta indica*, *Ocimum tenuiflorum*, *Allium sativum*, *Sapindus mukorossi* were evaluated (each @ 10% concentration) *In vitro* against *Colletotrichum gloeosporioides* causing anthracnose of guava, using "Poisoned Food Technique" with three replications in Completely Randomized Design. Among the fungicides evaluated Carbendazim 12% + Mancozeb 63% WP @ 1500 ppm and 2000 ppm, Tebuconazole 50% + Trifloxystrobin 25% WG @ 250 ppm and 500 ppm, Carbendazim 50% WP @ 1500 ppm, Thiophanate methyl 70% WP @ 500 ppm and 1000 ppm, Difenconazole 25% EC @ 1000 ppm and 1500 ppm showed 100 per cent inhibition of mycelial growth of *Colletotrichum gloeosporioides*. Iprovalicarb 5.5% + Propineb 61.25% WP @ 2000 ppm was least effective which showed 73.88% inhibition. Among the used organics, Soapnut rind extract was most effective in inhibiting the mycelial growth of test fungus with 72.58% (24.67mm). Followed by garlic clove extract (51.85%). *Lantana* was least effective in controlling the mycelial growth of *Colletotrichum gloeosporioides* (41.66%).

Keywords: Guava, *Colletotrichum gloeosporioides*, Fungicides, Organics

Introduction

Guava (*Psidium guajava* L.) is a most widely grown fruit crop belonging to family Myrtaceae. It is most commonly produced in the states of Bihar, Andhra Pradesh and Uttar Pradesh in India. Famous varieties grown in India are Sardar, Allahabad Safeda, Lalit, Pant Prabhat, Dhareedar, Arka Mridula, Khaja (Bengal Safeda), Chittidar, Harija and others. Guava is rich in minerals, vitamins, enzymes, phytochemicals, essential oils and antioxidants. Because of its many nutritional benefits and therapeutic applications, it is referred to as a "Magical Fruit". The majority of guava-growing regions worldwide are afflicted with anthracnose. Among the different plant-pathogenic fungi, *Colletotrichum* is the most prevalent and significant genera. The infection significantly decreased the market value of fruits and posed a major obstacle to the successful production of guava in Konkani zone of Maharashtra and other regions of the nation. This infection causes dead twigs on guava as well as necrotic lesions on fruit and foliage. The disease can cause the loss of up to 100% of the fruit that has been kept.

Materials and Methods

The present research work was carried out at the Department of Plant Pathology, College of Agriculture, Dr. Balasaheb Sawant Konkani Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri (M.S.).

Efficacy of eight fungicides viz., Carbendazim 12% + Mancozeb 63% WP, Metalaxyl 4% + Mancozeb 64% WP, Iprovalicarb 5.5% + Propineb 61.25% WP, Tebuconazole 50% + Trifloxystrobin 25% WG, Azoxystrobin 23% SC, Carbendazim 50% WP, Thiophanate methyl 70% WP, Difenoconazole 25% EC at different concentrations were tested *In vitro* against test pathogens separately by applying Poisoned Food Technique (Nene and Thapliyal, 1993) ^[10]. Three replications were maintained for each treatment. Extract of six plant species viz., *Lantana camara*, *Zingiber officinale*, *Azadirachta indica*, *Ocimum tenuiflorum*, *Allium sativum*, *Sapindus mukorossi* were evaluated (each @ 10% concentration) *In vitro*, using "Poisoned Food Technique" with three replications in Completely Randomized Design. The inoculated plates were incubated at room temperature (27±2 °C) for seven days and radial colony growth was measured. The efficacy of fungicides and organics was expressed as per cent inhibition of mycelial growth over control. Per cent inhibition was calculated by using the formula given by Vincent, 1947 ^[15].

$$\text{Per cent Inhibition (I)} = \frac{C-T}{C} \times 100$$

Where,

C = Growth (mm) of the test fungus in untreated control plate and

T = Growth (mm) of the test fungus in treated plates.

Results and Discussion

In vitro efficacy of fungicides against *Colletotrichum gloeosporioides*

Data from (Table 1, Plate 1 and Fig. 1) depicted that all the fungicide at two different concentrations were effective in inhibiting the mycelial growth of *Colletotrichum gloeosporioides*. Carbendazim 12% + Mancozeb 63% WP @ 1500 ppm and 2000 ppm, Metalaxyl 4% + Mancozeb 64% WP @ 1000 ppm and 1500 ppm, Tebuconazole 50% + Trifloxystrobin 25% WG @ 250 ppm and 500 ppm, Carbendazim 50% WP @ 1500 ppm, Thiophanate methyl 70% WP @ 500 ppm and 1000 ppm, Difenoconazole 25% EC @ 1000 ppm and 1500 ppm were the most significantly effective fungicides in inhibiting the mycelial growth of *Colletotrichum gloeosporioides* with 100 per cent inhibition over control and 0.00mm colony diameter. Carbendazim 50% WP @ 1000 ppm, Metalaxyl 4% + Mancozeb 64% WP @ 1500 ppm, Azoxystrobin @ 1000 ppm were the next best treatments in order of merits with per cent mycelial growth inhibition by 95.55% (4.00mm), 88.88% (10.00mm) and 88.70% (10.17mm). Azoxystrobin 23% SC @ 500 PPM, Metalaxyl 4% + Mancozeb 64% WP @ 1000 PPM, Iprovalicarb 5.5% + Propineb 61.25% WP @ 3000 PPM were also equally effective against test fungus with 83.14% (15.17mm), 82.96% (15.33mm) and 78.88% (19.00mm) mycelial growth inhibition, respectively. Iprovalicarb 5.5% + Propineb 61.25% WP @ 2000 ppm was

least effective which inhibited the mycelial growth of the test pathogen to the tune of 73.88% and maximum colony diameter than other treatments except control (23.50%).

The results of present investigation are in accordance with the results obtained by Ramani *et al.* (2015) ^[11] who found that complete mycelial growth inhibition of the *C. gloeosporioides* causing anthracnose of banana was observed due to Carbendazim 12% WP + Mancozeb 63% WP were most effective and gave 100% growth inhibition at all concentration viz., 100ppm, 250ppm, 500ppm and 1000ppm respectively. Dev and Narendrappa (2016) ^[6] observed that Trifloxystrobin 25%+Tebuconazole 50% WG showed cent percent inhibition at 100, 250, 500, 1000ppm concentrations against *C. gloeosporioides* causing anthracnose of pomegranate. Behera *et al.* (2019) examined the efficacy of against *Colletotrichum gloeosporioides* causing anthracnose in black pepper. He found that maximum growth inhibition of fungus was observed in case of Carbendazim 12%+Mancozeb 63% WP (0.1%) 97.26% which is followed by Carbendazim 50% WP (0.2%) 91.24%. Burgute and Magar (2019) ^[4] observed that Carbendazim 12%+Mancozeb 63% WP @ 2000ppm inhibited mycelial growth of *C. gloeosporioides* to the extent of 94.00%. Mahesh *et al.* (2020) carried out study on *In vitro* evaluation of fungicides against *C. gloeosporioides* causing anthracnose of guava, observed complete inhibition in mycelial growth of test fungus due to Difenoconazole 25% EC. The results are also in close proximity with the results obtained by Sharma *et al.* (2019) ^[12], Kadlag *et al.* (2023) ^[18] and Vanani *et al.* (2024) ^[14].

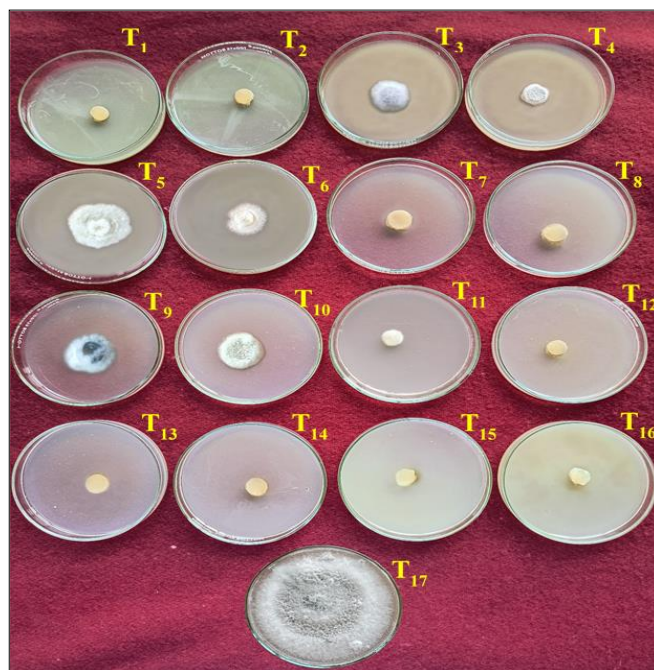


Plate 1: *In vitro* efficacy of fungicides against *Colletotrichum gloeosporioides*

Table 1: *In vitro* efficacy of fungicides against *Colletotrichum gloeosporioides*

Tr. No.	Treatments	Conc. (ppm)	Colony dia. (mm)*	Per cent Inhibition
T ₁	Carbendazim 12% + Mancozeb 63% WP	1500	0.00	100.00
T ₂	Carbendazim 12% + Mancozeb 63% WP	2000	0.00	100.00
T ₃	Metalaxyl 4% + Mancozeb 64% WP	1000	15.33	82.96
T ₄	Metalaxyl 4% + Mancozeb 64% WP	1500	10.00	88.88
T ₅	Iprovalicarb 5.5% + Propineb 61.25% WP	2000	23.50	73.88
T ₆	Iprovalicarb 5.5% + Propineb 61.25% WP	3000	19.00	78.88
T ₇	Tebuconazole 50% + Trifloxystrobin 25% WG	250	0.00	100.00
T ₈	Tebuconazole 50% + Trifloxystrobin 25% WG	500	0.00	100.00

T ₉	Azoxystrobin 23% SC	500	15.17	83.14
T ₁₀	Azoxystrobin 23% SC	1000	10.17	88.70
T ₁₁	Carbendazim 50% WP	1000	4.00	95.55
T ₁₂	Carbendazim 50% WP	1500	0.00	100.00
T ₁₃	Thiophanate methy 170% WP	500	0.00	100.00
T ₁₄	Thiophanate methy 170% WP	1000	0.00	100.00
T ₁₅	Difenoconazole 25% EC	1000	0.00	100.00
T ₁₆	Difenoconazole 25% EC	1500	0.00	100.00
T ₁₇	Control	-	90.00	-
	S.E. m±	-	0.27	-
	C.D. at 1%	-	1.05	-

* Mean colony diameter

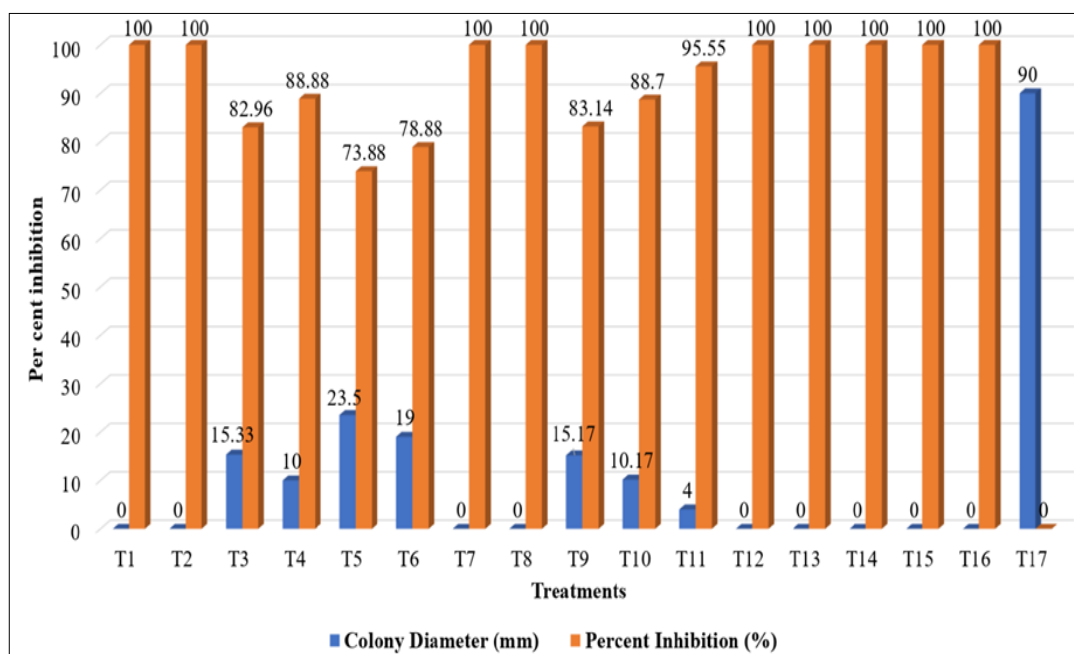


Fig 1: Colony diameter (mm) and per cent inhibition (%) of different fungicides against *Colletotrichum gloeosporioides*

In vitro efficacy of organics against *Colletotrichum gloeosporioides*

Data from table 2, plate 2 and fig. 2 revealed that all the organics evaluated were effective in inhibiting the mycelial growth of anthracnose causing fungus *Colletotrichum gloeosporioides*. Soapnut rind extract was most significantly effective in inhibiting the mycelial growth of test fungus with 72.58% (24.67mm). Followed by garlic clove extract 51.85% (43.33mm). Extract of Tulasi (46.47%) (48.17mm), neem (44.81%) (49.67mm), ginger (43.14%) (51.17mm) were also effective in inhibiting mycelial growth of the test fungus. Lantana was least effective in controlling the mycelial growth of *Colletotrichum gloeosporioides* with 41.66 per cent inhibition and 52.50mm colony diameter.

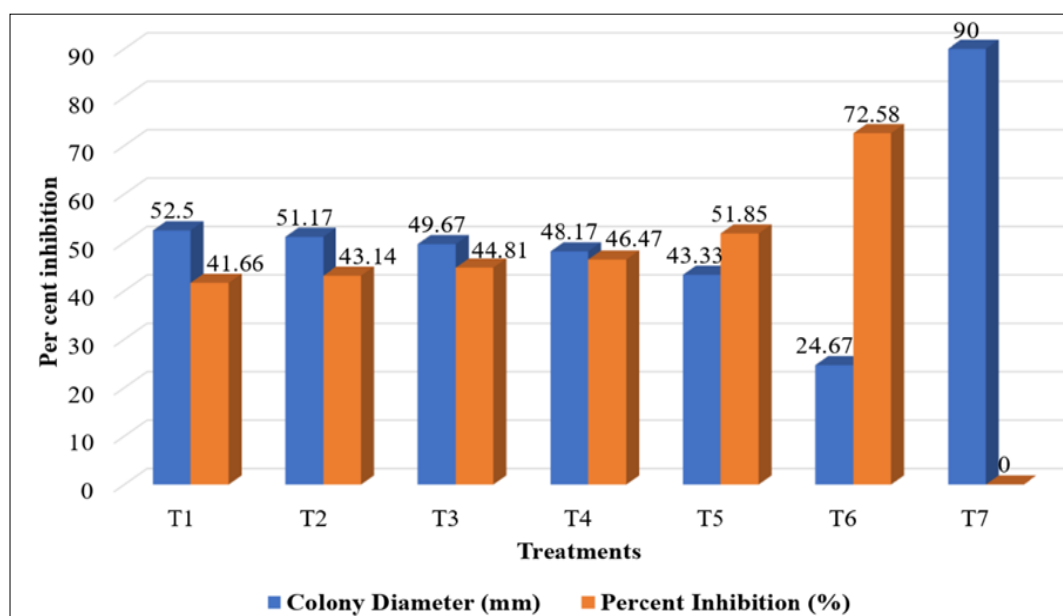
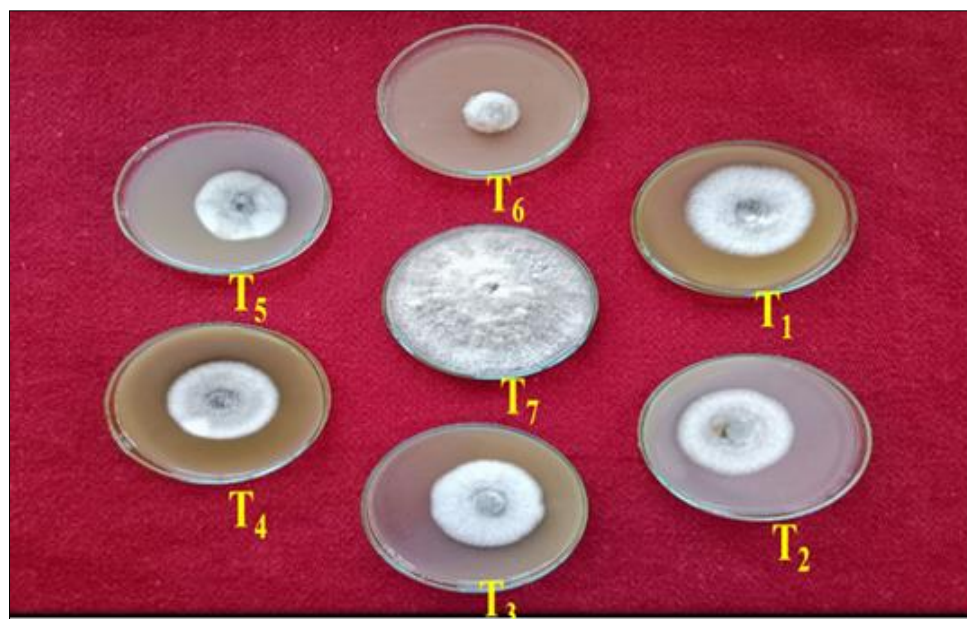
The results of present investigation are in accordance with the results obtained by Shovan *et al.* (2008) [13] evaluated efficacy of four different plant extracts at three different concentrations (5, 10 and 20%) against the *Colletotrichum dematium* causes anthracnose of soybean and found that garlic found to be superior which showed 48.70mm radial growth of fungus followed by onion, ginger and Neem extract. The present findings are also in close consonance with Jayalakshmi *et al.* (2013) [7] who evaluated plant extracts at three different concentrations (10, 20 and 30%) against *Colletotrichum gloeosporioides* causing anthracnose of pomegranate. Results

indicated that maximum inhibition in mycelial growth of the test pathogen was due to datura leaf (54.58%) and garlic bulb extract (7.80%) at 10%. Tulasi leaf extract showed least inhibition of mycelial growth (0.35%). Similarly, Alves *et al.* (2015) [11] analyzed *In vitro* evaluation of botanicals against *Colletotrichum gloeosporioides* causing anthracnose of bell pepper where they found that garlic reduce severity by 75%. The results of present investigation differ from the earlier findings of Ramani *et al.* (2015) [11] who studied antifungal properties of different plant extract viz., Lantana, Jatropha, Turmeric, Onion, Ardusi, Neem, Garlic, Ginger and Tulsi against *Colletotrichum gloeosporioides* at 2, 5 and 10 per cent concentration. Lantana leaf extract showed maximum growth inhibition of test fungus (61.45%). Bajad *et al.* (2018) [2] tested efficacy of nine botanicals against the *Colletotrichum dematium* causes anthracnose of onion. At 10 per cent, *Allium sativum* showed maximum mycelial growth inhibition by 84.44%. Chourasia and Jha (2021) [5] assessed *In vitro* efficacy of 8 medicinal plants extracts viz., *Datura stramonium* (Datura), *Curcuma longa* (Turmeric), *Azadirachta indica* (Neem), *Zingiber officinale* (Ginger), *Allium sativum* (Garlic), *Ocimum sanctum* (Tulsi), *Nyctanthus arbortristis* (Harsringar) and *Piper betle* (Betel/Paan) against *Colletotrichum gloeosporioides* causing fruit rot in guava. Results indicated that 80% inhibition in mycelial growth of the test pathogen was due to Garlic clove extract (10 mm).

Table 2: *In vitro* efficacy of organics against *Colletotrichum gloeosporioides*

Tr. No.	Common Name	Botanical Name	Colony dia. (mm)*	Per cent Inhibition
T ₁	Lantana	<i>Lantana camara</i>	52.50	41.66
T ₂	Ginger	<i>Zingiber officinale</i>	51.17	43.14
T ₃	Neem	<i>Azadirachta indica</i>	49.67	44.81
T ₄	Tulsi	<i>Ocimum tenuiflorum</i>	48.17	46.47
T ₅	Garlic	<i>Allium sativum</i>	43.33	51.85
T ₆	Soapnut	<i>Sapindus mukorossi</i>	24.67	72.58
T ₇	Control	-	90.00	-
S.E. m±			0.46	-
C.D. at 1%			1.93	-

* Mean colony diameter

**Fig 2:** Colony diameter (mm) and per cent inhibition (%) of different organics against *Colletotrichum gloeosporioides***Plate 2:** *In vitro* efficacy of fungicides against *Colletotrichum gloeosporioides***Conclusion**

From the results of present experiment, it is concluded among the different fungicides evaluated *In vitro*, 100% inhibition of mycelial growth found in Carbendazim 12% + Mancozeb 63% WP @ 1500 and 2000ppm, Tebuconazole 50% + Trifloxystrobin 25% WG@ 250 and 500ppm, Carbendazim 50% WP 1500ppm,

Thiophanate methyl 70% WP @ 500 and 1000ppm and Difenconazole 25% EC @ 1000 and 1500ppm. Among the different plant extracts evaluated, Soapnut rind extract and Garlic clove extract are most effective in inhibiting mycelial growth of *Colletotrichum gloeosporioides* causing anthracnose in guava.

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