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Bibhu Prasad Sethi
M.Sc., Department of Plant Pathology, Plant Pathology Section, College of Agriculture, Dhule, Maharashtra, India

Jitendra S Suryawanshi
Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Amol N Kale
Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Chintamani D Deokar
Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Chatur Thakare
Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Corresponding Author:
Bibhu Prasad Sethi
M.Sc., Department of Plant Pathology, Plant Pathology Section, College of Agriculture, Dhule, Maharashtra, India

In vitro efficacy of different fungicides against *Pestalotiopsis psidii* causing fruit canker of guava (*Psidium guajava* L.)

Bibhu Prasad Sethi, Jitendra S Suryawanshi, Amol N Kale, Chintamani D Deokar and Chatur Thakare

Abstract
Guava (*Psidium guajava* L.) is cultivated in almost every tropical and frost-free subtropical country on the planet. It is called the "Apple of tropics". It is a rich source of vitamin 'C', with high minerals and pectin content. Guava is prevalent in India at diverse elevations and environmental conditions throughout the tropical and subtropical states. *Pestalotiopsis psidii* (Pat.) Mordue causes scabby fruit canker, one of the most frequent fruit diseases in guava-growing countries. It affects all phases of guava fruit development. Scabby fruit canker can significantly reduce fruit yield during the pre-harvest stage and cause fruit losses during post-harvest storage. The infected fruits exhibited tiny dark necrotic lesions with scabby appearances. The pathogen was isolated by standard tissue isolation method and purified by single spore technique. Pathogenicity of fungus was proved by following Koch's postulates. Identification of the fungus was carried out at the Plant Pathology Section, College of Agriculture, Dhule. *In vitro* efficacy of fungicides, revealed that Carbendazim 50% WP @ (0.1%) and Propiconazole 25% EC @ (0.05%) inhibited mycelial growth of the test fungus significantly (93.10%, 92.36% respectively), followed by Copper Oxychloride 50% WP @ (0.2%), Mancozeb 75% WP @ (0.25%), Difenoconazole 25% EC @ (0.05%). Whereas, it was the least with Hexaconazole 5% EC @ (0.05%).

Keywords: Guava, fruit canker, *Psidium guajava* L., Pestalotiopsis psidii, fungicides, *in-vitro* efficacy, inhibition

Introduction
Guava (*Psidium guajava* L.) is a popular, sweet fruit that's abundantly cultivated in tropical and subtropical parts of India. Guava is a high source of vitamin C, pectin and minerals. In terms of vitamin 'C' concentration, it is ranked third behind Barbados cherry and Aonla. Fruits are served fresh and also utilized for the manufacture of processed food products such as jam and jelly *etc*. It is primarily grown in Bihar and Uttar Pradesh, as well as Maharashtra, Karnataka and Madhya Pradesh in India. Guava farming covers 2,65,000 hectares, or 4.07 percent of the country's total fruit cultivation area, with a yield of 40.54 lakh metric tonnes, whereas in Maharashtra, it covers 9,700 hectares, with production of 1, 22,380 MT (Horticulture at glance, 2018) [1]. Maharashtra contribute 3.02% to India`s total guava production in 2017-18. In India and Maharashtra, guava yields 15.3 and 13.55 MT per hectare, respectively. Guava suffers economic losses due to some important diseases *viz.*, *Pestalotiopsis psidii. Fusarium oxysporium* and *Colletotrichum gloeosporioides* which produce fruit canker, wilt, and anthracnose on guava, respectively. Among these diseases, Guava fruit canker/scab is the most common disease in India. *Pestalotiopsis psidii* (Pat.) Mordue is a parasitic fungus that is the major source of scabby fruit canker occurrence. This disease reduces marketability and quality of guava fruit along with deteriorated yield. The disease has resulted in 30-60 percent losses on average, but in extremely severe cases, the loss might reach 100 percent. The disease has been shown to inflict major losses in the Maharashtra districts of Dhule and Jalgaon. So, keeping, the economic importance of the disease and its effect on quality of guava fruit production, in mind, the present research was carried out at Plant Pathology Section, College of Agriculture, Dhule during 2020-2021.

2. Material and Methods
To find out the *in-vitro* efficacy of fungicides against the test fungus (*Pestalotiopsis psidii.*), six different fungicides were used as treatments, by following the Poison Food Technique

(Suggested by Nene and Thapliyal in 1982) [4]. To attain the required concentration of poisoned media, every single fungicide, at specific quantity, was mixed with molten PDA separately in different conical flasks. The poisoned media poured in each petri plate is about 20ml. It kept for a while to get it solidified, under aseptic condition. Then, mycelial disc of 5 mm diameter, were placed on the poisoned medium at the center of the plate. Control plates, treated without any fungicide were maintained. All the treatments were replicated three times each, along with the control plate. These plates were incubated inside the BOD incubator at 27°±1 °C for seven days. The colony diameters of the test fungus in each of the plate were measured and calculated the percent inhibition of growth over control (suggested by Vincent, 1947) [9].

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

Where, I = Percent growth Inhibition; C = Radial growth on control plate; T = Radial growth of test fungus on petriplate.

3. Results and Discussion

The results (Table-1, Fig.-1 & 2, Plate-1) revealed that, among the fungicides tested under *in-vitro* condition along with one control (Untreated), Carbendazim 50% WP (93.10%) and Propiconazole 25% EC (92.36%) were found to be significantly superior than all other treatments in inhibiting the growth of *Pestalotiposis psidii* over control. Copper Oxychloride 50% WP (91.63%) was also found to be at par with the previous two fungicides exhibiting scanty sporulation and no white mycelial growth. Further, Mancozeb 75% WP (85.93%) with scanty sporulation and Difenconazole 25% EC (81.40%) with moderate sporulation and Hexaconazole 5% EC (76.46%) with moderate sporulation.

Table 1: *In-vitro* evaluation of Fungicides against *Pestalotiopsis psidii*

Tr. No.	Fungicides	Concentration	Colony diameter (mean) (in mm)*	Sporulation	(%) Growth Inhibition
T1	Propiconazole 25% EC	0.05%	6.66	-	92.36
T2	Mancozeb 75% WP	0.25%	12.33	++	85.93
T3	Copper Oxychloride 50% WP	0.20%	7.33	-	91.63
T4	Carbendazim 50% WP	0.10%	6.00	-	93.10
T5	Hexaconazole 5% EC	0.05%	20.66	+	76.46
T6	Difenconazole 25% EC	0.05%	16.33	+	81.40
T7	Control (Untreated)	-		+++	-
	S.E. (m) ±		0.579		
	C.D. (@ 1%)		2.430		

*= Average of three replications

Sporulation Grade: +++: Good Sporulation; **++:** Moderate Sporulation; **+:** Scanty Sporulation; **-:** No sporulation

1. Propiconazole 25% EC
2. Mancozeb 75% WP
3. Copper Oxychloride 50% WP
4. Carbendazim 50% WP
5. Hexaconazole 5% EC
6. Difenoconazole 25% EC

C- Control (Untreated)

Plate 1: *In-vitro* evaluation of fungicides against *Pestalotiopsis psidii*

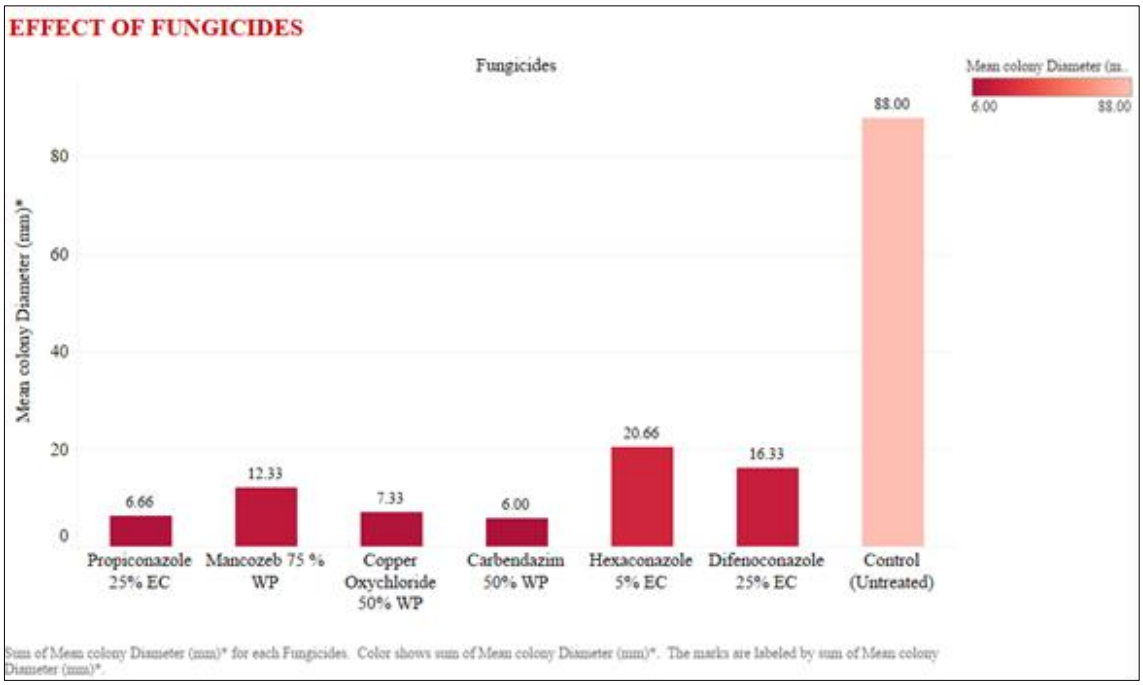

Fig 1: *In-vitro* evaluation of fungicides against *Pestalotiopsis psidii* (Colony diameter)

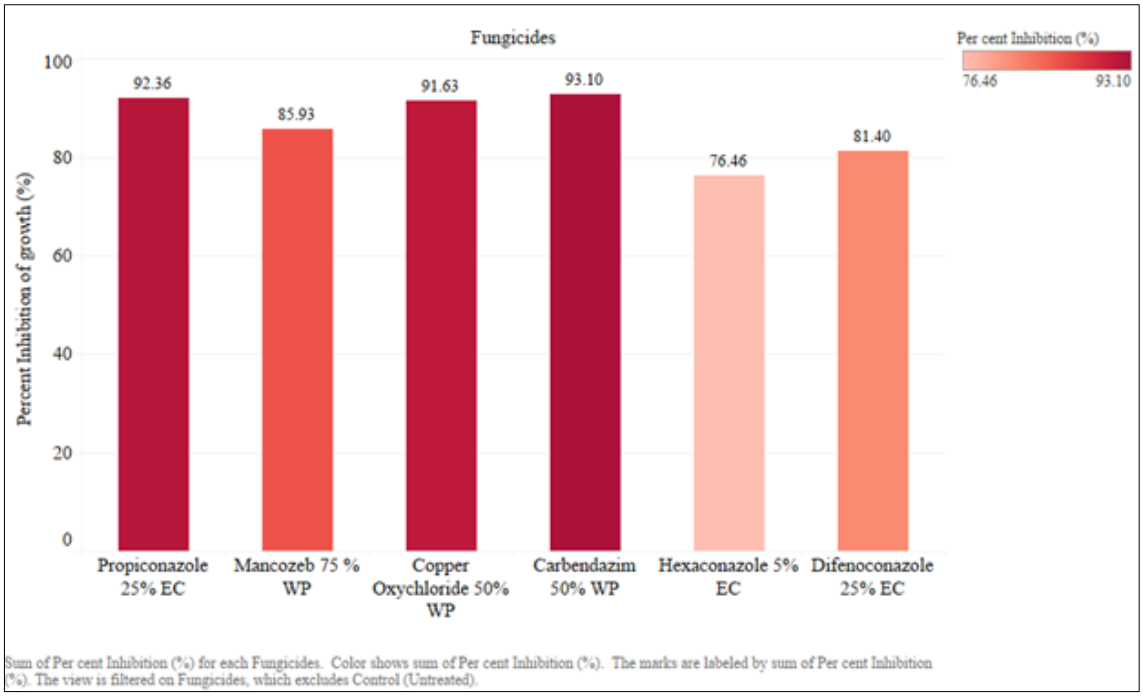

Fig 2: *In-vitro* evaluation of fungicides against *Pestalotiopsis psidii* (Percent growth inhibition)

The outcome of the present experiment is in accordance with the results achieved by Rao *et al.* (2012) [6]. He had confirmed that Carbendazim and Benomyl could exhibit maximum inhibition of mycelial growth of *P. psidii.* Fruits treated with Carbendazim @0.1% resulted significant reduction in incidence of fruit canker disease. Ray *et al.* (2007) also achieved the similar results. He discovered Carbendazim and Mancozeb as effective fungicides against *P. psidii* [7].

4. Conclusions

Hence, from ongoing results and discussion, it is concluded that *in vitro* testing of fungicides against *Pestalotiopsis psidii* revealed that among the fungicides, Carbendazim 50% WP (@ 0.05% concentration) and Propiconazole 25% EC (@ 0.1% concentration) recorded highest inhibition (93.10 percent and 92.56 percent respectively) of mycelial growth under *in-vitro* condition. These fungicides can further be utilized for field trials and recommendation should be provided to the farmers accordingly.

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