International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(6): 2949-2951

Received: 05-11-2020
Accepted: 16-12-2020

Das Tanmoy
School of Crop Protection, College of Post Graduate Studies in Agricultural Sciences, Central Agricultural University, Imphal, Umiam, Meghalaya, India

Tombisana Devi RK
School of Crop Protection, College of Post Graduate Studies in Agricultural Sciences, Central Agricultural University, Imphal, Umiam, Meghalaya, India

Satyanarayana MSV
School of Crop Protection, College of Post Graduate Studies in Agricultural Sciences, Central Agricultural University, Imphal, Umiam, Meghalaya, India

Rajesh T
School of Crop Protection, College of Post Graduate Studies in Agricultural Sciences, Central Agricultural University, Imphal, Umiam, Meghalaya, India

Corresponding Author:
Das Tanmoy
School of Crop Protection, College of Post Graduate Studies in Agricultural Sciences, Central Agricultural University, Imphal, Umiam, Meghalaya, India

In vitro management of *Pestalotiopsis mangiferae* causing grey leaf blight of mango by fungicides

Das Tanmoy, Tombisana Devi RK, Satyanarayana MSV and Rajesh T

DOI: https://doi.org/10.22271/chemi.2020.v8.i6ap.11937

Abstract
Mango (*Mangifera indica* L.) is one of the most important commercially grown fruit crops in India and is also known as the national fruit of the country. In mango, out of the all diseases, grey leaf blight disease has a great economic importance. An *in vitro* experiment was performed by screening different fungicides against *Pestalotiopsis mangiferae*, the causal agent of the disease by poisoned food technique. Amid fungicides tested, carbendazim 12% + mancozeb 63% @ 0.15, 0.2 and 0.25%, cymoxanil 8% + mancozeb 64% @ 0.15, 0.2 and 0.25% and copper oxychloride @ 0.2% were found best in inhibiting the pathogen growth by 100 percent and recorded highest inhibition (%) over control in comparison with control.

Keywords: *In vitro*, management, *Pestalotiopsis mangiferae*, mango, fungicides

Introduction
Mango (*Mangifera indica* L.), a member of Anacardiaceae, is the most important commercially grown fruit crops of India. It is known to be the king of fruits and also the national fruit of India. Mango is believed to have its origin in South-East Asia, most probably in North-East India, North Western Myanmar, and Bangladesh (Das *et al*., 2019) [2]. India, also a prominent exporter of fresh mangoes to the world. The country has exported 49,658.68 MT of fresh mangoes to the world for the worth of Rs. 400.21 crores/ 56.11 USD Millions during the year 2019-20. The major mango-growing states are Andhra Pradesh, Uttar Pradesh, Karnataka, Bihar, Gujarat and Tamil Nadu. Uttar Pradesh ranks first in mango production with a share of 23.47% (APEDA, 2019) [1]. Among the important varieties and hybrids, mostly Amarapali, Himsagar and Mallika are being cultivated in NE India (Das *et al*., 2019) [2]. Different diseases in mango plantation are responsible for the considerable yield loss in this region. Among various fungal diseases, grey leaf blight considered to be an important disease which is commonly observed in NE India. Looking to the seriousness of the disease and economic importance of the crop, present investigation was undertaken to study the efficacy of fungicides against disease and to generate necessary information for suitable chemical management measures to minimize crop losses.

Materials and Methods
Isolation of the pathogen
In the present investigation, the diseased samples were collected from different locations *viz*., orchards, residence as well as roadside plantations. Small portions from infected leaves (5mm) along with the healthy tissue were separated with sterile scalpel and subjected to surface sterilization with NaOCl (1%) solution for 30 seconds followed by three subsequent washings with sterilised distilled water and dried for 10 minutes on tissue paper and then transferred to potato dextrose agar in Petri dishes aseptically. Then the inoculated plates were then incubated at 27±1 °C and pure culture of the pathogen was obtained by hyphal tip isolation method. The purified culture was then used in the study.

Evaluation of fungicides against mango grey leaf blight (*Pestalotiopsis mangiferae*)
Efficacy of six fungicides, which includes systemic fungicides such as, carbendazim, thiophanate methyl, carbendazim 12% + mancozeb 63%, cymoxanil 8% + mancozeb 64% and non-systemic fungicides such as mancozeb, copper oxychloride, at three different levels of

of concentrations tested against *Pestalotiopsis mangiferae in vitro* by poisoned food technique (Nene and Thapliyal, 1993) [4]. The amount of each fungicide to make the required concentration was mixed properly in melted potato dextrose agar media (PDA) in an aseptic environment and poured aseptically into Petri dishes and allowed to solidify. Each Petri dish was inoculated with 5mm mycelial disc of 7 days old vigorously growing culture. A Petri plate without fungicide inoculated with 5 mm mycelial disc at the centre of the plate used as control. Each treatment was replicated three times and then the inoculated plates were incubated at 27±1°C. Radial mycelial growth (mm) of the test pathogen was recorded when the control plates were observed with full mycelial growth. Per cent growth inhibition over control was calculated using the formula of Kumari *et al*., (2017) [3]. The inhibition (%) of the respective treatment over control was calculated by considering the radial mycelial growth of pathogen in control.

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

Where
I = Per cent inhibition
C = Mycelial growth in control
T = Mycelial growth in treatment

Results and Discussion
In vitro evaluation of fungicides against mango grey leaf blight pathogen (*P. mangiferae*) revealed that, all the fungicides significantly reduced the growth of target pathogen as compared to control (Table 1), but their concentrations significantly differed within themselves. Among all concentrations, the higher concentration of each fungicide produced maximum growth inhibition of the pathogen. Among all the fungicides tested the combination products i.e. carbendazim 12% + mancozeb 63% (SAAF 75% WP) and cymoxanil 8% + mancozeb 64% (CURZAT M8 72% WP) proved to be the best with 100 percent growth inhibition at each concentration (Fig. 1). Systemic fungicides were found more inhibitory as compared to non-systemic fungicides even at equal levels of concentration against the pathogen. Amid systemic fungicides, thiophanate methyl (TOPSIN-M 70% WP) shown slightly better growth inhibition (99.81%) @ 0.15% compared to carbendazim (96.99%) at the same concentration. Copper oxychloride (100%) showed its maximum inhibition @0.2%. Whereas, least mycelial inhibition was recorded with mancozeb (0.2%) by 62.27% over control in the assay. High inhibitory efficiency by SAAF 75% WP (carbendazim 12% + mancozeb 63%) and CURZAT M8 72% WP (cymoxanil 8% + mancozeb 64%) have also been recorded against *Pestalotiopsis mangiferae* by Patil *et al*. (2019) [5]. The experimental results were in similar with the findings of yang *et al*. (2011) [8] who reported that carbendazim + mancozeb performed best in inhibiting the spindle microtubules assembly and restricting the mitotic and cell division of the fungi which showed its best fungistatic activity over target pathogen. The high effectiveness of carbendazim against the grey leaf blight pathogen has also been reported earlier by Rakesh (*et al*., 2020) [7]. According to Rahman (*et al*., 2013) [6] carbendazim depicted very effective, whereas, mancozeb was noticed as less effective fungicide.

Table 1: Effect of different concentrations of fungicides on *P. mangiferae*

Treatment (s)	Concentrations (%)	Per cent growth inhibition
Systemic fungicides		
Carbendazim (BAVISTIN 50% WP)	0.05	91.06 (75.04)
	0.1	94.44 (79.97)
	0.15	96.99 (83.23)
Thiophonate methyl (TOPSIN-M 70% WP)	0.05	97.27 (82.95)
	0.1	97.78 (84.41)
	0.15	99.81 (89.46)
Contact fungicides		
Mancozeb (DITHANE M 45 75% WP)	0.1	39.21 (38.73)
	0.15	45.28 (42.25)
	0.2	62.27 (52.10)
Copper oxychloride (BLITOX 50% WP)	0.05	93.89 (77.50)
	0.1	97.87 (84.85)
	0.2	100.00 (89.97)
Combination product (Systemic + Contact)		
Carbendazim 12% + Mancozeb 63% (SAFF 75% WP)	0.15	100
	0.2	100
	0.25	100
Cymoxanil 8% + Mancozeb 64% (CURZAT M8 72% WP)	0.15	100
	0.2	100
	0.25	100
S.Em (±)		0.58
CD (p=0.05)		1.61

Note: Values are the averages of three replicates, values in the parentheses are arc sine transformed values

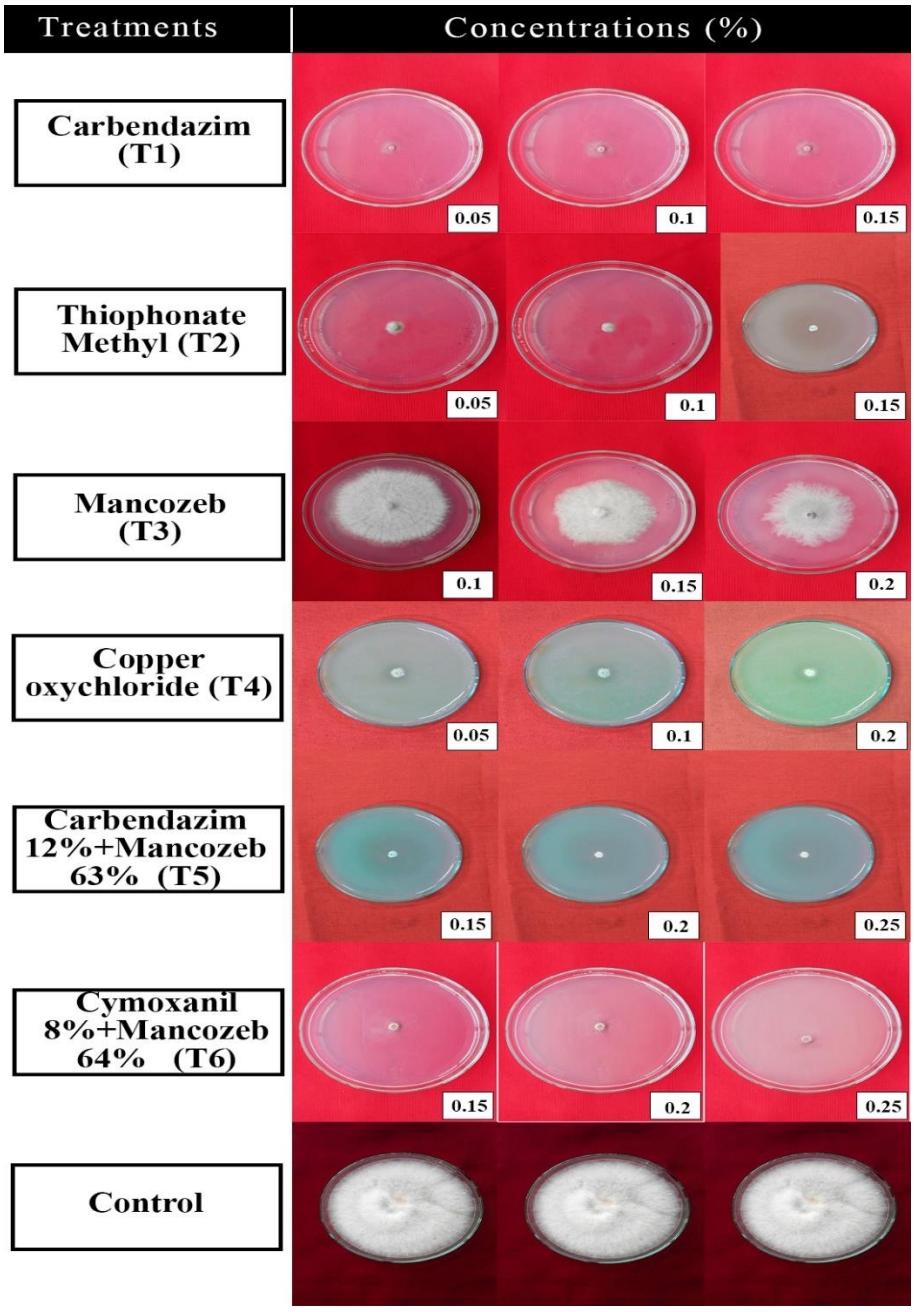

Fig 1: Efficacy of fungicides against *P. mangiferae in vitro*

Conclusion

Fungicides provides a quick response and action over any pathogens, among various fungicides tested carbendazim 12% + mancozeb 63% and cymoxanil 8% + mancozeb 64% influenced less mycelial growth and found best in controlling the grey leaf blight in mango under laboratory conditions.

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