International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(2): 3493-3495

Received: 05-01-2018
Accepted: 06-02-2018

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In vitro efficacy of ready mix fungicides against *Rhizoctonia solani* kühn causing root rot of coriander

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Abstract
The efficacy of different ready mix fungicides tested under *in vitro* condition was capable of inhibiting the mycelial growth of *Rhizoctonia solani* Kühn at various concentrations as compared to control. Tebuconazole 50% + tryfloxistrobin 25% WG gave significantly the maximum mean mycelial growth inhibition (76.46 per cent). The next best was metiram 55% + pyraclostrobin 5% WG with mean mycelial growth inhibition of 58.33. Whereas, cymoxanil 8% + mancozeb 64% WP was the least effective ready mix fungicide with 4.43 per cent mean mycelial growth inhibition under laboratory condition.
The effect of different concentrations of ready mix fungicides on sclerotial formation was found negatively correlated with the inhibition of growth. No sclerotial formation was found in tebuconazole 50% + trifloxystrobin 25% WG at 250, 500 and 1000 ppm concentration as well as in metiram 55% + pyraclostrobin 5% WG and carbendazim 12% + mancozeb 63% WP at 500 and 1000 ppm and carboxin 37.5% + thiram 37.5% WP at 1000 ppm. Abundant sclerotial formation was found in all concentration of cymoxanil 8% + mancozeb 64% WP and hexaconazole 4% + zineb 68% WP *in vitro*.

Keywords: coriander, root rot, *Rhizoctonia solani*, ready mix fungicides

Introduction
Coriander (*Coriandrum sativam* L.) also known as cilantro, Chinese parsley or dhania is one of the most important spice crops in the world belonging to the family *Apiaceae.* It is affected by many fungal, bacterial and viral diseases. But fungal diseases *viz*., root rot (*Rhizoctonia solani*), wilt (*Fusarium oxysporum* f. sp. *corianderii*), and powdery mildew (*Erysiphe polygoni*) and stem gall caused by *Protomyces macrosporus* cause serious problems in terms of quality and quantity of seeds.
Among different fungal diseases, the crop was found to be infected from root rot disease in mild to moderate form in Junagadh district of Gujarat state. In view to study the effectiveness of different ready mix fungicides against test pathogen under laboratory conditions, this experiment was planned.

Materials and Methods
In vitro evaluation of ready mix fungicides
Mycelial growth inhibition activities of different concentration of ready mix fungicides (Table 1) were tested against *R. solani* under *in vitro* condition by employing poisoned food technique of Bagchi and Das (1968) using Potato Dextrose Agar (PDA) as a germinating medium. The quantity of each ready mix fungicides required were incorporated into autoclaved measured PDA medium before solidification with micropipette and then medium were poured into sterilized Petri dishes (90 mm dia.) in equal quantity (Twenty ml per Petri dish) to form a uniform layer. The experiment was arranged in FCRD with three repetitions.
These plates were then allowed to solidify. After solidification the plates were inoculated with an actively growing mycelial bit of four mm diameter which was transferred under aseptic conditions over the solidified PDA medium. The mycelial disc was placed in the center of plates in an inverted position to make a direct contact with the poisoned medium. Then Petri plates were incubated at 28 $\pm$ 2° C for seven days and observations were recorded on radial growth of mycelium in treated and control plates. Inoculated Petri plates containing PDA medium without ready mix fungicides were served as control.
The radial growth of the fungal colonies was measured from two different angles in millimeter

(mm) and the average values were calculated. The per cent growth inhibition of the fungus in each treatment was calculated by using following formula (Vincent, 1947).

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

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

Sclerotial formations were counted in fungal culture suspension under microscope at low power (10x). The fungal culture suspension was prepared by vigorously shaking of the four mm mycelial disc of the fungus in 10 ml sterilized distilled water. The relative degree of sclerotial formation was recorded as below.

No of sclerotia per microscopic field (10x)	Grade	Sign
0	Absent	-
1-4	Scanty	+
5-8	Moderate	++
9-15	Good	+++
>15	Abundant	++++

Table 1: *In vitro* evaluation of ready mix fungicides

S. No	Ready mix Fungicides	Concentrations (ppm)			
		1	2	3	4
1.	Carbendazim 12% + Mancozeb 63% WP	100	250	500	1000
2.	Carboxin 37.5% + Thiram 37.5% WS	100	250	500	1000
3.	Cymoxanil 8% + Mancozeb 64% WP	100	250	500	1000
4.	Hexaconazole 4% + Zineb 68% WP	100	250	500	1000
5.	Metiram 55% + Pyraclostrobin 5% WG	100	250	500	1000
6.	Tebuconazole 50 % + Trifloxystrobin 25% WG	100	250	500	1000

Results and Discussion

In vitro evaluation of ready mix fungicides against *R. solani*

The relative efficacy of six different ready mix fungicides was tested at the concentration of 100, 250, 500 and 1000 ppm using poison food technique. The data on per cent inhibition of mycelia growth and sclerotial formation are presented in Table 2 and depicted in Fig. 1.

Data presented in Table 2 indicated that tebuconazole 50% + Tryfloxystrobin 25% WG gave significantly the maximum mean mycelial growth inhibition (76.46 per cent). The next best was metiram 55% + pyraclostrobin 5% WG with mean mycelial growth inhibition of 58.33. Whereas, cymoxanil 8% + mancozeb 64% WP was the least effective ready mix fungicide with 4.43 per cent mean mycelial growth inhibition.

Among different ready mix fungicides tested *in vitro*, tebuconazole 50% + tryfloxystrobin 25% WG gave 86.56, 88.45 and 99.98 per cent mycelial growth inhibition at 250, 500 and 1000 ppm concentrations, respectively which was the best treatment for inhibiting the growth of mycelium of *R. solani* under laboratory conditions.

The moderately effective ready mix fungicides in inhibiting the mycelial growth were metiram 55% + pyraclostrobin 5% WG with 99.98 per cent at 500 and 1000 ppm followed by carboxin 37.5% + thiram 37.5% WS with 83.51 per cent at 1000 ppm and cabendazim 12% + mancozeb 63% WP with 82.89 and 83.41 per cent at 500 and 1000 ppm concentration, respectively. The least effective ready mix fungicides were hexaconazole 4% WP + zineb 68% WP with (3.94, 5.40, 5.56 and 6.41) and cymoxanil 8% + mancozeb 64% WP with (2.05, 2.58, 2.94 and 10.17) per cent mycelial growth inhibition at 100, 250, 500 and 1000 ppm concentration, respectively.

The effect of different concentrations of ready mix fungicides on sclerotial formation was found negatively correlated with the inhibition of growth. No sclerotial formation was found in tebuconazole 50% + trifloxystrobin 25% WG at 250, 500 and 1000 ppm concentration as well as in metiram 55% + pyraclostrobin 5% WG and carbendazim 12% + mancozeb 63% WP at 500 and 1000 ppm and carboxin 37.5% + thiram 37.5% WS at 1000 ppm. Abundant sclerotial formation was found in all concentration of cymoxanil 8% + mancozeb 64% WP and hexaconazole 4% + zineb 68% WP.

While, carbendazim 12% + mancozeb 63% WP; carboxin 37.5% + thiram 37.5% WS and metiram 55% + pyraclostrobin 5% WG each at 100 and 250 ppm concentration, respectively exhibited abundant sclerotial formation.

More or less similar trend was also reported by Prajapati *et al*. (2002). They recorded that carbendazim, carbendazim + thiram, carboxin and thiophanate methyl completely inhibited the growth of *R. bataticola* isolated from chickpea. Similarly, Dileep Kumar (2016) studied the broad spectrum action of a nanoform commercial fungicide trifloxystrobin 25% + tebuconazole 50% (75 WG) with improved antifungal activity against *Macrophomina phaseolina*.

Table 2: Effect of ready mix fungicides on mycelial growth inhibition and sclerotial formation of *R. solani* under *in vitro* condition.

Ready mix fungicides	Growth inhibition (%) and sclerotial formation				Mean inhibition (%)
	100 ppm	250 ppm	500 ppm	1000 ppm	
Carbendazim 12% + Mancozeb 63% WP	9.75 (2.92)	12.30 (4.57)	65.58 (82.89)	65.98(83.41)	38.39 (43.44)
	++++	++++	-	-	
Carboxin 37.5% + Thiram 37.5% WS	21.73 (13.74)	24.09 (16.66)	54.62 (66.45)	66.06(83.51)	41.62(45.09)
	++++	++++	++	-	
Cymoxanil 8% +Mancozeb 64% WP	8.18(2.05)	9.16(2.58)	9.79(2.94)	18.52(10.17)	11.41(4.43)
	++++	++++	++++	++++	
Hexaconazole 4% +Zineb 68% WP	11.33(3.94)	13.41 (5.40)	13.60 (5.56)	14.63 (6.41)	13.24 (5.32)
	++++	++++	++++	++++	
Metiram 55% + Pyraclostrobin 5% WG	21.73 (13.74)	26.29 (19.62)	89.62 (99.98)	89.62 (99.98)	56.81 (58.33)
	++++	++++	-	-	
Tebuconazole 50% + Trifloxystrobin 25% WG	33.75(30.87)	68.52 (86.56)	70.18 (88.45)	89.62 (99.98)	65.51 (76.46)
	+++	-	-	-	
	Fungicide (F)		Conc. (C)		F x C
S. Em. ±	0.42		0.34		0.83
C. D. at 5%	1.19		0.97		2.37
C. V. %	3.81				

Sclerotial formation

++++ =Abundant; +++= good; ++ = moderate; + = scanty; - = no sclerotial formation. Values in parentheses are re-transformed values while outside transformed with arcsine transformation before analysis.

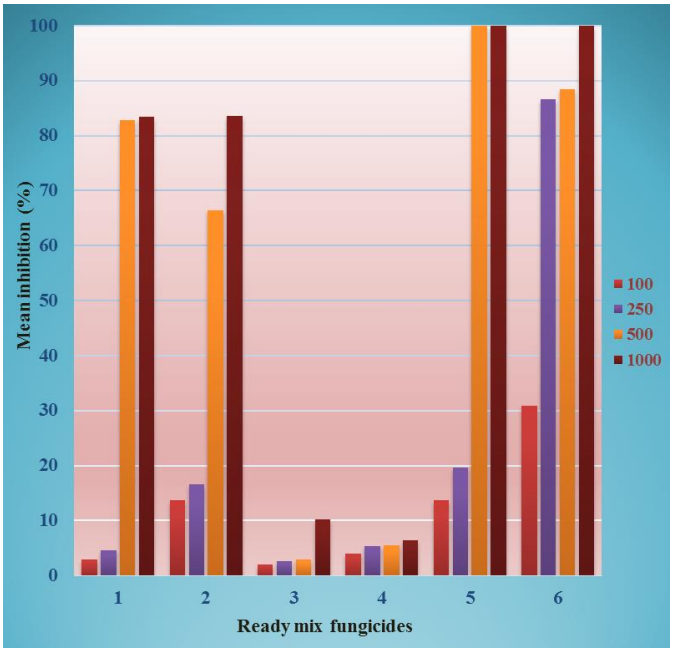

Fig 1: Effect of ready mix fungicides on mycelial growth inhibition of *R. solani* under *in vitro* condition

1.	Carbendazim 12% + Mancozeb 63% WP
2.	Carboxin 37.5% + Thiram 37.5% WS
3.	Cymoxanil 8% + Mancozeb 64% WP
4.	Hexaconazole 4% + Zineb 68% WP
5.	Metiram 55% + Pyraclostrobin 5% WG
6.	Tebuconazole 50% + Trifloxystrobin 25% WG

References

1. Bagchi BN, Das CR. Studies on biological spectrum and sensitivity of some fungicides. Ind. Phytopath. 1968; 21:394-400.
2. Dileep Kumar G, Natarajan N, Nakkeeran S. Antifungal activity of nano fungicide Trifloxystrobin 25% + Tebuconazole 50% against Macrophomina phaseolina. Afr. J. Microbiol. Res. 2016; 4:100-105.
3. Prajapati RK, Gangwar RK, Srivastava SS, Ahamad Shahid. Efficacy of fungicides, non-target pesticides and bioagents against the dry root rot of chickpea. Ann. Pl. Prot. Sci. 2002; 10(1):154-155.
4. Vincent J M. Distortion of fungal hyphae in the presence of certain inhibitor. Nature. 1947; 159:850.