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Research Article

In Vitro Evaluation of Fungicides against *Curvularia geniculata* Causing Fruit Spot of Pomegranate

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Abstract

The pomegranate (*Punica granatum* L.), is one of the ancient and highly praised favorite fruit belongs family Lythraceae of Myrtales order which is mainly grown in tropical and subtropical regions of the world. Studies on in vitro evaluation of non-systemic, systemic and combi fungicides against *Curvularia geniculata* were carried out in the department of Horticultural Crop Protection, College of Horticulture, Hiriyur during 2017-2018. Among the non-systemic fungicides evaluated maximum per cent inhibition (100 %) was recorded in mancozeb and propineb which was followed by copper oxychloride (89.58 %). Least per cent inhibition of fungus was recorded in chlorothalonil (57.17 %). Among the systemic fungicides evaluated maximum per cent inhibition (100%) was recorded in tebuconazole, hexaconazole, propiconazole followed by pyraclostrobin (93.25 %). Least per cent inhibition was recorded in difenconazole (92.29 %). Among the combi products cent per cent inhibition of growth of fungus was recorded in all the combi products like propiconazole + difenoconazole, tebuconazole + trifloxystrobin, pyraclostrobin + epoxiconazole, carbendazim + macozeb and metalaxyl-M + mancozeb against *C. geniculata* at all the three concentration 0.1, 0.2 and 0.3 per cent.

Keywords: Pomegranate, *Curvularia geniculata*, Blight, fungicides

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Introduction

Pomegranate is one of the most valuable fruit crops commercially grown in different regions of India and has export value too. Maharashtra leads in pomegranate production in country and the total area under cultivation is approximately 94 thousand hectares with the annual production of 6.5 lac tons [1]. In recent years, pomegranate industry is affected by severe diseases resulting into decreased productivity and quality. Dieback is a severe disease caused by *Ceratocystis fimbriata*, *Fusarium oxysporum*, *Meloidogyne incognita*, *Cytospora punica*, *Pleuroplaconema* sp. or *Centhospora* sp. and *Phyllosticta* sp. The market value of fruits is affected by fruit spot and fruit rot diseases that are caused by species of *Alternaria*, *Aspergillus*, *Beltaraniella*, *Cercospora*, *Cladosporium*, *Colletotrichum*, *Curvularia*, *Fusarium*, *Phomopsis*, *Phytophthora*, *Rhizopus etc* [2].

Shekar [3] noted that leaf spot and fruit rot of pomegranate caused due to *C. lunata*. Utikar *et al*. [4] reveled that fruit rotting (spotting) of pomegranate due to *C. lunata*. Madhukar and Reddy [5] reported leaf spot of pomegranate caused by *C. lunata*. Shete [6] reported that blackening of arils (seeds) of pomegranate caused due to *C. lunata*. There is only a little information available on the management of fungal fruit spot of pomegranate, but now a days there are large number of chemicals available in the market and their bio-efficacy and suitability needs to be verified by *in vitro* studies and later it should be extended to field condition. Keeping in view of the economic importance of the fruit and destructive nature of fungal fruit spot diseases and extent of losses caused to pomegranate in the state, the present study was undertaken.

Material and Methods

The efficacy of five non-systemic, five systemic and five combi fungicides were tested against *C. geniculata* for radial growth inhibition on the potato dextrose agar media using poisoned food technique under *in vitro* condition [7]. The non-systemic and combi fungicides were tried at 0.1, 0.2 and 0.3 per cent concentration, whereas systemic fungicides were tried at 0.05, 0.1, 0.15 per cent concentrations. The calculated quantities of fungicides were thoroughly mixed in the medium before pouring into Petri plates so as to get the desired concentration of active ingredient of each fungicide separately. Twenty ml of fungicide amended medium was poured in each of 90 mm sterilized Petri plates and allowed to solidify. The plates were inoculated centrally with 8 mm disc of 10 days old young sporulating culture of *C. geniculata*. Controls without fungicides were also maintained. The experiment was conducted in Completely Randomised Design (CRD) with three replications in each treatment. The inoculated Petri plates were incubated at 25 ± 2°C. The colony diameters were measured after 10 days when the control plates were full of fungal growth. Per cent inhibition of growth was calculated by using formula given by Vincent [8].

$$I = [(C - T)/ (C)] \times 100$$

Where, I=Per cent inhibition; C=Colony diameter in control; T=Colony diameter in treatment

Statistical analysis

The experimental data collected were analyzed statistically for its significance of difference by the normal statistical procedure adopted for completely randomized design and interpretation of data was carried out. The level of significance used in 'F' and 'T' test was P = 0.05 and P = 0.01. Critical differences were calculated wherever 'F' test was significant. The values percent disease index was subjected to angular transformation according to the table given by Sundarraj *et al*. [9].

Results and Discussion

Among the non-systemic fungicides evaluated cent per cent inhibition of growth of *C. geniculata* was recorded in mancozeb and propineb which was followed by copper oxychloride (89.58 %). Least per cent inhibition of fungus was recorded in chlorothalonil (57.17 %). Mancozeb and propineb were significantly superior over all other fungicides evaluated in inhibiting the growth of fungus. At 0.3 per cent, cent per cent inhibition of growth of fungus was recorded in mancozeb, propineb followed by copper oxychloride (92.32 %). Least per cent inhibition (64.70 %) was recorded in chlorothalonil. At 0.2 per cent mancozeb, propineb gave cent per cent inhibition which was followed by copper oxychloride (90.10 %) while least per cent inhibition was recorded in chlorothalonil (55.55 %). At 0.1 per cent mancozeb, propineb gave cent per cent inhibition which was followed by copper oxychloride (86.33 %) (**Table 1**). Chlorothalonil gave least per cent inhibition (51.28 %). The results were in conformity with the work of Panwar [10] and Kithan and Dahio [11]. Mancozeb and Propineb were effective because they react with the protein SH groups and because of their broad-spectrum activity they were effective.

Table 1 *In vitro* evaluation of non-systemic fungicides against *C. geniculata*

Sl. No	Fungicides	Inhibition (%)			
		Concentration (%)			
		0.1	**0.2**	**0.3**	**Mean**
1	Captan 50%WP	77.54[#](61.75) *	82.19(65.08)	84.31(66.71)	81.34(64.51)
2	Copper oxychloride 50%WP	86.33(68.34)	90.10(71.71)	92.32(74)	89.58(71.35)
3	Chlorothalonil 75% WP	51.28(45.76)	55.55(48.21)	64.70(53.60)	57.17(49.19)
4	Mancozeb 75%WP	100(90.05)	100(90.05)	100(90.05)	100(90.05)
5	Propineb 70 %WP	100(90.05)	100(90.05)	100(90.05)	100(90.05)
		Fungicides (F)	Concentration (C)	F × C	
	S.Em. ±	0.64	0.83	0.37	
	CD @ 1%	2.40	3.11	1.38	

[#] Mean of five replications, * Figures in the parenthesis are arcsine transformed values

Among the different systemic fungicides evaluated maximum per cent inhibition (100 %) of growth of *C. geniculata* was recorded in tebuconazole, hexaconazole, propiconazole followed by pyraclostrobin (93.25 %). Least per cent inhibition was recorded in difenconazole (92.29 %). At 0.15 per cent tebuconazole, hexaconazole, propiconazole gave cent per cent inhibition followed by pyraclostrobin (95.01 %). Whereas difenconazole recorded least per cent inhibition (94.75 %). At 0.1 per cent tebuconazole, hexaconazole, propiconazole gave cent per cent inhibition followed by pyraclostrobin (93.44 %). Least per cent inhibition (92.70 %) was recorded in difenconazole. At 0.05 per cent tebuconazole, hexaconazole, propiconazole gave cent per cent inhibition followed by pyraclostrobin (91.30 %) (**Table 2**). Least per cent inhibition (89.42 %) was recorded in difenconazole. The results are in similarity with the work of Menaria [12]. Among the different combi products evaluated maximum per cent inhibition (100 %) was recorded in all the combi products evaluated like propiconazole + difenoconazole, tebuconazole + trifloxystrobin, pyraclostrobin + epoxiconazole, carbendazim + macozeb and metalaxyl-M + mancozeb against *C. geniculata* at all the three concentration 0.1, 0.2 and 0.3 per cent (**Table 3**). The results are in similarity with the earlier work of Panwar [10], Sumangala and Patil [13], Kim and Hwag [14] and Bisht *et al.* [15]. Ekabote and Narayanaswamy [16] reported that Difenconazole was next best effective fungicide in the management of anthracnose of pomegranate after Trifloxystrobin + Tebuconazole. The effectiveness of the triazole fungicides like propiconazole, hexaconazole and tebuconazole may be attributed to their interfeance with the biosynthesis of fungal sterols and inhibit the ergosterol biosynthesis and they also act as demethylase inhibitor interferes in process of building the structure of fungal cell wall. Finally, it's going to inhibit the reproduction and further growth of fungus. In many fungi, ergosterol is essential to the structure of cell all and its absence cause irreparable damage to cell wall leading to death of fungal cell where as strobilurins act through inhibition of respiration by binding to the Qo center of the cytochrome b. These strobilurins are very broad and balance spectrum of activity. Strobilurins also works by interfering with the respiration of pathogenic fungi and site of action of Strobilurin compound is located in the mitochondrial respiration pathway.

Table 2 *In vitro* evaluation of systemic fungicides against *C. geniculata*

Sl. No	Fungicides	Inhibition (%)			
		Concentration (%)			
		0.05	**0.1**	**0.15**	**Mean**
1	Pyraclostrobin 100 g/l CS	91.30 (72.91)	93.44 (75.21)	95.01 (77.17)	93.25 (74.09)
2	Difenoconazole 25% EC	89.42 (71.12)	92.70(74.39)	94.75 (76.89)	92.29 (74.13)
3	Tebuconazole 25.9% EC	100 (90.05)	100 (90.05)	100 (90.05)	100 (90.05)
4	Hexaconazole 5% SC	100 (90.05)	100 (90.05)	100 (90.05)	100 (90.05)
5	Propiconazole 25% EC	100 (90.05)	100 (90.05)	100 (90.05)	100 (90.05)
		Fungicides (F)	Concentration (C)	F × C	
	S.Em. ±	0.53	0.69	0.31	
	CD @ 1%	1.98	2.58	1.16	

Mean of five replications, * Figures in the parenthesis are arcsine transformed values

Table 3 *In vitro* evaluation of combi products against *C. geniculata*

Sl. No	Fungicides	Inhibition (%)			
		Concentration (%)			
		0.1	**0.2**	**0.3**	**Mean**
1	Carbendazim 12%+ Mancozeb 63% WP	100#(90.05) *	100(90.05)	100(90.05)	100(90.05)
2	Propiconazole13.9%+ Difenconazole 13.9% EC	100(90.05)	100(90.05)	100(90.05)	100(90.05)
3	Metalaxyl-M 4% + Mancozeb 64% WP	100(90.05)	100(90.05)	100(90.05)	100(90.05)
4	Tebuconazole 50%+Trifloxystrobin 25% WG	100(90.05)	100(90.05)	100(90.05)	100(90.05)
5	Pyraclostrobin 133g/l + Epoxiconazole 50g/l SE	100(90.05)	100(90.05)	100(90.05)	100(90.05)
		NS	NS	NS	

Mean of five replications, * Figures in the parenthesis are arcsine transformed values

Conclusion

Among the non-systemic fungicides evaluated maximum per cent inhibition (100 %) was recorded in mancozeb and propineb. Systemic fungicides tebuconazole, hexaconazole, propiconazole completely inhibited the growth of *C. geniculata*. Among the combi product evaluated maximum per cent inhibition (100 %) was recorded in all the combi products evaluated like propiconazole + difenoconazole, tebuconazole + trifloxystrobin, pyraclostrobin + epoxiconazole, carbendazim + macozeb and metalaxyl-M + mancozeb against *C. geniculata*.

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