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Management of Alternaria Leaf Spot of Cotton

I Venkatesh, S L Bhattiprolu, J Krishna Prasadji and G Ramachandra Rao
Department of Plant Pathology, Agricultural college, Bapatla – 522 101, Andhra Pradesh

ABSTRACT

Six fungicides and three bio-control agents were evaluated for their efficacy on *Alternaria alternata*, the causal agent of cotton leaf spot in both *in vitro* and *in vivo*. Mancozeb 0.3%, hexaconazole 0.2% and propiconazole 0.1% recorded 100% inhibition in poisoned food technique and *Trichoderma viride* (TNAU isolate) caused 78.55% inhibition of *A. alternata* in dual culture. Combined treatment of seed treatment with mancozeb 3 g/kg and foliar spray of propiconazole 0.1% reduced per cent disease index to 21 that accounted for a disease control of 43% with yield of 1831 kg ha^{-1}, an increased yield of 61% and benefit cost ratio of 1.69.

Key words : *Alternaria alternata*, Biocontrol agents,Cotton leaf spot, Fungicides.

Cotton is one of the most important commercial crops of the world providing livelihood to about 60 Million people and is an important agricultural commodity providing remunerative income to millions of farmers both in developed and developing countries. In India, in spite of severe competition from synthetic fibres, it is occupying the premier position with 70% share in the textile industry. India is the largest cotton growing country in the world with an area of around 11.7 M ha followed by China (5.3 M ha). Cotton production of India is 25.5 M bales of 480 kg and productivity is 475 kg ha^{-1}. India's share in global cotton exports is around 22%.

In India, cotton is cultivated on a large scale in Maharashtra, Gujarat, Andhra Pradesh, Karnataka, Madhya Pradesh, Punjab, Rajasthan, Haryana, Tamil Nadu and Uttar Pradesh. Andhra Pradesh stands third in area with 2.27 M ha and production of 7.20 M bales but sixth in productivity with 496.39 kg ha^{-1} during 2013-14 (AICCIP, 2013).

The major foliar diseases of cotton in India are fungal leaf spots, bacterial blight and cotton leaf curl virus which were reported to cause yield losses up to 20 to 30% (Mayee and Mukewar, 2007). Among fungal diseases, leaf spot/blight caused by *Alternaria macrospora* Zimm. is the most commonly occurring disease in Andhra Pradesh. Under favourable conditions, losses to the tune of 26.59 % (Monga *et al*., 2013) and 38.23% (Bhattiprolu and Prasada Rao, 2009) were recorded.

MATERIAL AND METHODS

Effect of fungicides on mycelial growth of *Alternaria alternata*

Selected fungicides *viz*., mancozeb, captan, hexaconazole, propiconazole, kresoxim methyl and captan+hexaconazole were evaluated *in vitro* against *A. alternata* by employing poisoned food technique (Nene and Thapliyal, 1993). Each treatment was replicated three times by adopting Completely Randomized Design. Aseptically inoculated both poisoned as well as non poisoned food media in Petri plates with *A. alternata* and incubated at 25±1^{0}C in a BOD incubator for twelve days till the growth was full in the control plate. Per cent inhibition of growth over control was calculated using the formula given by Vincent (1927).

Effect of bio-control agents on radial growth of *Alternaria alternata*

Two isolates of *Trichoderma viride*, two isolates of *Pseudomonas fluorescens* and one isolate of *Bacillus subtilis* were evaluated for their antagonistic effect on the growth of *A. alternata* by employing dual culture technique. Each treatment was replicated four times by adopting Completely Randomized Design. Aseptically inoculated Petri plates were incubated at 25±1^{0}C in a BOD incubator till the growth of the *A. alternata* was full in the control plate. Inhibition of growth was calculated after full growth in the control plate.

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Field experiment was conducted during *kharif* 2012-13 at the Regional Agricultural Research Station, Lam, Guntur, Andhra Pradesh. The experiment was laid out in a Randomized Block Design with ten treatments *viz*., seed treatment (ST) with *Pseudomonas fluorescens* 10g/kg and foliar spray (FS) of 0.4% Pf at 50, 70 and 90 days after sowing (T_1), ST with *Trichoderma viride* (TNAU isolate)10 g/kg and FS of 0.4% Pf at 50, 70 and 90 DAS (T_2), ST with *Bacillus subtilis* 10 g/kg and FS of 0.4% Pf at 50, 70 and 90 DAS (T_3), ST with mancozeb 3 g/kg and FS of 0.1% kresoxim methyl at 50, 70 and 90 DAS (T_4), ST with mancozeb 3 g/kg and FS of 0.1% captan + hexaconazole at 50, 70 and 90 DAS (T_5), ST with mancozeb 3 g/kg and FS of 0.1% propiconazole at 50, 70 and 90 DAS (T_6), ST with captan 3 g/kg and FS of 0.1% kresoxim methyl at 50, 70 and 90 DAS (T_7), ST with captan 3 g/kg and FS of 0.1% captan+hexaconazole at 50, 70 and 90 DAS (T_8), ST with captan 3 g/kg and FS of 0.1% propiconazole at 50, 70 and 90 DAS (T_9), untreated control (T_{10}) and three replications. Susceptible variety Narasimha was sown at a spacing of 105 x 60 cm. Seed treatment was imposed at the time of sowing. The chemical treatments were applied as sprays to run off at twenty days interval starting from 50 DAS and subsequent sprays at 70 and 90 DAS. Seven days after last spraying the disease severity in different treatments was recorded using 0-4 scale (Sheo Raj, 1988) and per cent disease index (PDI) was calculated by using the formula given by Wheeler (1969).

RESULTS AND DISCUSSION

Effect of fungicides

All the fungicide treatments significantly reduced the mycelial growth of the *A. alternata* in comparison with control. Mancozeb @ 0.3%, hexaconazole @ 0.2% and propiconazole @ 0.1% completely inhibited mycelial growth of *A. alternata* (Table 1). Gholve *et al*. (2012) recorded 88.83% inhibition of *A. macrospora* isolated from cotton with mancozeb at 1500 ppm and Vihol *et al*. (2009) observed 100% inhibition of *A. burnsii* causing cumin blight with mancozeb at 2500 ppm.

Effect of biocontrol agents

All the biocontrol agents significantly reduced the growth of *A. alternata* compared to control. TV (TNAU isolate) was found to be the most effective in reducing the growth of *A. alternata* to 19.3 mm dia and caused the highest inhibition of 78.55% followed by TV (PDBC isolate) with 29.5 mm dia and 67.22% inhibition (Table 2). Gholve *et al*. (2012) recorded that mycelial growth of 32.72 mm dia and inhibition of 63.64% of *A. macrospora* of cotton with *T. viride*. Treatment with *T. viride* resulted in 65% inhibition

Table 1. *In vitro* efficacy of fungicides against *A. alternata* causing leaf spot of cotton.

S. No	Treatment	Radial growth (mm)*	Inhibition (%)
1	Mancozeb 0.3%	0.0(0.7)[a]	100.0
2	Captan 0.3%	42.7(6.6)[c]	52.6
3	Hexaconazole 0.2%	0.0(0.7)[a]	100.0
4	Propiconazole 0.1%	0.0(0.7)[a]	100.0
5	Kresoxim methyl 0.1%	54.3(7.4)[d]	39.6
6	Captan+Hexaconazole 0.1%	11.3(3.4)[b]	87.4
7	Control	90.0(9.5)[e]	—
	SEm ±	0.03	
	CD (P d" 0.05)	0.10	
	CV%	1.48	

* Mean of three replications

Figures in parentheses are square root transformed values

Treatment means with same alphabet do not differ significantly

Table 2. *In vitro* efficacy of biocontrol agents against *A. alternata* causing leaf spot of cotton.

S.NO	Treatment	Radial growth (mm)*	Inhibition (%)
1	TV (TNAU)	19.3 (4.4)[a]	78.55
2	TV (PDBC)	29.5 (5.5)[b]	67.22
3	PF (Nagpur)	68.5 (8.3)[d]	23.89
4	PF (PDBC)	69.3 (8.4)[e]	23.00
5	BS (PDBC)	66.5 (8.2)[c]	26.11
6	Control	90.0 (9.5)[f]	—
	SEm ±	0.03	
	CD (P d" 0.05)	0.10	
	CV%	1.00	

* Mean of three replications
Figures in parentheses are square root transformed values
Treatment means with same alphabet do not differ significantly

Table 3. Effect of fungicides and biocontrol agents on Alternaria leaf spot disease and yield of cotton.

Treatment	PDI*	PDC	Yield* (kg/ha)	Per cent increase in yield	BCR
ST with Pf 10 g/kg and FS with 0.4% Pf at 50, 70 and 90 DAS	23.7 (29.1)[b]	36.0	1715.0[b]	51.0	1.61
ST with Tv 10 g/kg and FS with 0.4% Pf at 50, 70 and 90 DAS	24.0 (29.3)[b]	35.0	1709.0[b]	50.0	1.60
ST with Bs 10g/kg and FS with 0.4% Pf at 50, 70 and 90 DAS	27.0 (31.3)[c]	27.0	1640.0[b]	44.0	1.54
ST with mancozeb 3 g/kg and FS 0.1% kresoxim methyl at 50, 70 and 90 DAS	23.0 (28.6)[a]	38.0	1747.0[a]	54.0	1.41
ST with mancozeb 3 g/kg and FS 0.1% captan + hexaconazole at 50, 70 and 90 DAS	21.7 (27.7)[a]	41.0	1811.0[a]	59.0	1.65
ST with mancozeb 3 g/kg and FS 0.1% propiconazole at 50, 70 and 90 DAS	21.0 (27.2)[a]	43.0	1831.0[a]	61.0	1.69
ST with captan 3 g/kg and FS 0.1% at kresoxim methyl 50, 70 and 90 DAS	25.3 (30.2)[b]	31.0	1665.0[b]	46.0	1.35
ST with captan 3 g/kg and FS 0.1% captan+hexaconazole at 50, 70 and 90 DAS	28.7 (32.4)[c]	22.0	1619.0[b]	42.0	1.48
ST with captan 3 g/kg and FS 0.1% propiconazole at 50, 70 and 90 DAS	26.7 (31.1)[c]	28.0	1645.0[b]	45.0	1.52
Untreated control	37.0 (37.5)[d]	-	1138.0[c]	-	1.07
SEm ±	0.72		34.25		
CD (P d" 0.05)	2.15		101.78		
CV%	4.13		7.70		

Figures in parentheses are arc sine transformed values
Treatment means with same alphabet do not differ significantly
* Mean of three replications

of *A. alternata* infecting tomato (Panchal and Patil, 2009) and 69.8 % inhibition of *A. burnsii* infecting cumin (Vihol *et al*., 2009).

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Combination treatments of seed treatment with mancozeb 3 g/kg and foliar spray of 0.1% propiconazole, ST with mancozeb 3 g/kg and FS of 0.1% captan+hexaconazole and ST with mancozeb 3 g/kg and FS of 0.1% kresoxim methyl treatments were statistically on a par. Combined treatment of seed treatment with mancozeb 3 g/kg and foliar spray of propiconazole 0.1% reduced per cent disease index to 21 that accounted for a disease control of 43% with yield of 1831 kg ha^{-1}, an increased yield of 61% and benefit cost ratio of 1.69. Bhaskaran and Shanmugam (1973) and Desai (1979) found that mancozeb was effective in reducing the infection of *A. macrospora*. The lowest cotton Alternaria leaf spot disease was observed with mancozeb, which gave maximum kapas yield (Savanur, 1984). Propiconazole 0.1% was found to lower Alternaria blight severity and increase cotton yield (Chattannavar *et al*., 2010). Based on the present results it is concluded that seed treatment with mancozeb @ 3 g/kg seed and three foliar sprays with 0.1% propiconazole at 20 days interval will protect the crop from this important disease.

LITERATURE CITED

AICCIP 2013 Annual Report (2012-13) *All India Coordinated Cotton Improvement Project,* Coimbatore, Tamil Nadu.

Bhaskaran R and Shanmugam N 1973 Laboratory evaluation of some fungicides against *Alternaria macrospora* Zimm. *Madras Agricultural Journal*, 60: 646-647.

Bhattiprolu S L and Prasada Rao M P 2009 Estimation of crop losses due to Alternaria leaf spot in cotton. *Journal of Indian Society for Cotton Improvement*, 14: 151-154.

Chattannavar S N, Hosagoudar G N and Ashtaputre 2010 Crop loss estimation due to foliar diseases in cotton. *Karnataka Journal of Agricultural Sciences*, 23: 559 – 601.

Desai S A 1979 Studies on Alternaria leaf spot and twig blight of cotton in Karnataka. *M. Sc.* (*Ag*) *Thesis*, University of Agricultural Sciences, Bangalore, Karnataka.

Gholve V M, Jogdand S M and Jagtap G P 2012 *In vitro* evaluation of fungicides, bio-agents and aqueous leaf extracts against Alternaria leaf blight of cotton. *Scientific Journal of Veterinary Advances*, 1: 12-21.

Mayee C D and Mukewar P M 2007 Loss-inducing diseases of cotton and their management with special reference to Andhra Pradesh. In: *Cotton in Andhra Pradesh*. Ed. Rao N.G.P, Rao, A and Siddiq, E.A., Farm and Rural Science Foundation and ANGRAU, Hyderabad. A. P. 197-199 pp.

Monga D, Sreelakshmi B L and Prakash A H 2013 Crop losses due to important cotton diseases. Central Institute for Cotton Research, Nagpur, *Technical Bulletin*, 9 pp.

Nene Y L and Thapliyal P N 1993 *Fungicides in Plant Disease Control*. 2nd ed., Oxford and IBH publication, New Delhi, India, 413-415 pp.

Panchal D G and Patil R K 2009 Eco-friendly management of fruit rot of tomato caused by *Alternaria alternata*. *Journal of Mycology and Plant Pathology,* 39: 66-69.

Savanur R D 1984 Studies on leaf spot of cotton caused by *Alternaria macrospora* Zimm. *M. Sc. (Ag) Thesis*, University of Agricultural Sciences, Bangalore, Karnataka.

Sheo Raj 1988 Grading system for cotton diseases, Central Institute for Cotton Research, Nagpur, *Technical Bulletin*, 1-7 pp.

Vihol J B, Patel K D, Jaiman R K and Patel N R 2009 Efficacy of plant extracts, biological agents and fungicides against Alternaria blight of cumin. *Journal of Mycology and Plant Pathology,* 39: 516-519.

Vincent J M 1927 Distortion of fungal hyphae in the presence of certain inhibitors. *Nature*, 59: 850.

Wheeler B E J 1969 *An Introduction to Plant Diseases*. John Wiley publication, London. 301 pp.

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