Management of Frog Eye Leaf Spot (*Cercospora nicotianae* Ellis & Everh) in flue cured Virginia tobacco

S. K. DAM AND U. SREEDHAR

J. Mycopathol, Res, 57(1) : 13-16, 2019;
ISSN 0971-3719

Department of Botany,
University of Calcutta,
Kolkata 700 019, India

J. Mycopathol. Res. ***57(1)*** *:13-16, 2019;* (ISSN 0971-3719)

Management of Frog Eye Leaf spot (*Cercospora nicotianae* Ellis & Everh) in flue cured Virginia tobacco

S. K. DAM[1*] AND U. SREEDHAR[2]
[1] *ICAR- Central Tobacco Research Institute(CTRI) Research Station, Dinhata 736 135, Cooch Behar, West Bengal*
[2] *Head, Division of Crop Protection, ICAR- Central Tobacco Research Institute, Rajahmundry 533 105, Andhra Pradesh*

Received : 16.01.2019 Accepted : 21.01.2019 Published : 29.04.2019

Management of frog eye leaf spot of tobacco was attempted consecutively for two seasons under natural field epiphytotic conditions. Four fungicides viz., Azoxystrobin 23% SC @ 0.1%, Propiconazole 25% EC @ 0.1%, Kresoxim methyl 44.3% SC @ 0.1%, Pyraclostrobin + Metiram 60% WG @ 0.2% alongwith Carbendazim 50% WP @ 0.05% were evaluated for their effectiveness in controlling frog eye leaf spot of tobacco. Fungicides were tested *in vitro* by poisoned food technique for their efficacy to inhibit mycelial growth of the pathogen and were found inhibitory to the fungus with varied degree of inhibition. Under field conditions, application of all the fungicides twice resulted in lower disease severity and higher grade index than untreated check plots. Pyraclostrabin + Metiram 60% WG @ 0.2% alongwith Carbendazim 50% WP @ 0.05% were most effective for the management of the disease in FCV tobacco.

Key words: *Cercospora nicotianae*, FCV tobacco (*Nicotiana tabacum*), frog eye leaf spot, fungicides, management

INTRODUCTION

Diseases caused by fungal pathogens are a major constraint for production of quality tobacco. Among the fungal diseases, frog eye spot caused by *Cercospora nicotianae* El. & Eve. is one of the serious diseases in tobacco causing losses in the range of 5 to 20 per cent depending on the intensity. Brown, round spots resembling frog eye appear initially on basal leaves and gradually spread to upper leaves. Spots are small, circular, brown or tan with grey centres. In severe cases spots coalesce to become bigger spots leading to drying of leaves (Lucas, 1975). Management of the disease with recommended fungicides provide good control of the disease continue to decrease in view of the restrictions imposed by tobacco importing countries due to the problem of residues in cured tobacco leaf. Carbendazim has been recommended and is in use since three decades for the management of this disease in tobacco and its indiscriminate use resulting in pesticide residues in cured leaf is a cause of concern. Hence, in the present study alternative new fungicides has been evaluated against the pathogen *C. nicotianae*, the incitent of frog eye leaf spot diseases in order to identify the most effective fungicide for management of the disease in FCV tobacco field crop.

*Corresponding author: damskd01@yahoo.co.in

MATERIALS AND METHODS

a. Laboratory studies

Efficacy of five fungicides, *viz.*, azoxystrobin, propiconazole, kresoxim methyl, pyraclostrobin + metiram and carbendazim were evaluated against *C. nicotianae* at five different concentrations i.e. 100, 250, 500, 1000 and 2000 ppm following the poisoned food technique using 2% potato dextrose agar medium (Nene and Thapliyal, 2000). Five

replications each with five plates were maintained for each treatment. The plates were inoculated with reversed 5 mm size circular disc of inoculum from 10 days old culture at the centre of the plate, in such a way that the fungus comes in direct contact with the medium. The medium without fungicide served as control. The Petri dish were incubated at 27±1^{0}C for 10 days or after the mycelial growth has fully covered the Petri dish in control. The efficacy of various fungicides was assessed by measuring the radial growth of the fungal colony in mm. The per cent inhibition of pathogen over control was calculated.

b. Field experiment

The field experiment was conducted for two crop seasons 2013-14 and 2014-15 at experimental farm, ICAR- Central Tobacco Research Institute, Rajahmundry, Andhra Pradesh to test the bio-efficacy of new fungicides against frog eye spot disease, *C. nicotianae* in FCV tobacco. The crop was raised as per standard agronomic practices during the season (October to March).

The experiment was laid out in a randomized block design (RBD), with 6 treatments (plot size of 12.25 m^2) and replicated four times. The popular FCV tobacco cultivar Siri was used in the experiment. The treatments consisted of 5 fungicides viz., azoxystrobin 23% SC @ 0.1%, propiconazole 25% EC @ 0.1%, kresoxim methyl 44.3% SC @ 0.1%, pyraclostrobin + metiram 60% WG @ 0.2%, carbendazim 50% WP @ 0.05% and an untreated check. The fungicides were applied twice at an interval of 15 days starting from the initiation of the disease. The observations were recorded before and one week after each spray. Five randomly selected plants from each replication were considered for scoring the disease. Per cent disease index (PDI) was calculated on the basis of 0-5 rating scale (0= no infection, 1= 1-20% leaf infection (li), 2= 21-40% li, 3= 41-60% li, 4= 61-80% li and 5= more than 80% li). The final assessment of the disease was calculated based on the formula of Wheeler (1969) and presented in Table 2. The average of all five observations was subjected to analysis of variance. Yield parameters viz., cured leaf and quality leaf yield were also recorded. Loss of yield and quality due to the disease in untreated plots were also assessed by comparing with effective chemical control treatments. The data were statistically analysed by following statistical procedures of Sukhatme and Amble (1985).

RESULTS AND DISCUSSION

a. Laboratory studies

Inhibition of mycelial growth over control on 10th day for each dosage of chemical are presented in Table 1. Among the five fungicides evaluated against *C. nicotianae* all were inhibitory to the fungus with varied degree of inhibition. The results indicated that carbendazim was the most effective as it checked 100 per cent growth of fungus even at 100 ppm. Propiconazole, kresoxim methyl and pyraclostrobin + metiram showed complete inhibition at 1000 ppm whereas, azoxystrobin was effective at 2000 ppm. The efficacy of various groups of systemic and non-systemic fungicides viz., penconazole, benomyl, hexaconazole, propiconazole, carbendazim, carbendazim + mancozeb, thiophanate methyl, difenconazole, mancozeb, propineb, copper oxychloride and chlorothalonil on growth inhibition of *C. nicotianae* and *C. beticola* to varying extents was earlier reported by Ruppel and Petersen, (1977) and Prakash,(2007). The results of the present study are in agreement with earlier findings on the efficacy of systemic fungicides on frog eye leaf spot in tobacco.

b. Field experiment

The pooled data of two seasons (Table.2) indicate that foliar spray of carbendazim @ 0.05 per cent immediately after appearance of the disease followed by another spray at 15 days interval recorded minimum per cent disease index (PDI) of 19.92 which was on par with pyraclostrobin + metiram @ 0.2% (19.94 PDI) followed by kresoxim methyl @ 0.1 per cent (21.03 PDI). Among the fungicides, the performance of propiconazole @ 0.1 per cent (21.23 PDI) and azoxystrobin @ 0.1 per cent (21.24 PDI) in terms of checking the incidence of the disease was inferior. All were superior to untreated check with more than 40 per cent reduction of PDI over control. Maximum disease incidence was noticed in untreated plots (31.36 PDI).

The pooled data on yield parameters showed that cured leaf yield was highest (2526 kg/ha) in azoxystrobin treatment followed by kresoxim

Table 1: Effect of different fungicides on the mycelial growth inhibition of *Cercospora nicotianae*

Fungicides	% inhibition of mycelial growth over control/ concentrations (ppm)					Mean
	100	250	500	1000	2000	
Azoxystrobin 23% SC	68.89	70.00	77.78	82.23	100	79.78
	(56.07)	(56.78)	(61.86)	(65.12)	(90.00)	(65.96)
Propiconazole 25% EC	91.11	93.33	94.44	100	100	95.78
	(72.64)	(75.00)	(76.33)	(90.00)	(90.00)	(80.78)
Kresoxim methyl	92.22	92.22	94.44	100	100	95.77
44.3% SC	(73.80)	(73.80)	(76.33)	(90.00)	(90.00)	(80.78)
Pyraclostrobin + Metiram	82.22	88.89	100	100	100	94.22
60% WG	(65.06)	(70.50)	(90.00)	(90.00)	(90.00)	(81.09)
Carbendazim 50% WP	100	100	100	100	100	100
	(90.00)	(90.00)	(90.00)	(90.00)	(90.00)	(90.00)
Mean	86.88	88.88	93.33	96.44	100	
	(71.50)	(73.22)	(78.89)	(84.99)	(90.00)	
	Fungicides (F)	Conc. (C)	F x C			
S Em ±	0.26	0.26	0.58			
C. D (p=0.05)	0.72	0.72	1.61			

Figures in parentheses are angular transformed values

Table 2: Efficacy of fungicides and economics of management of frog eye spot disease in FCV tobacco

Treatment details	Per cent disease Index			% reduction over check	Tobacco yield Cured leaf (kg/ha)			Grade index				
	2013-14	2014-15	Pooled		2013-14	2014-15	Pooled	2013-14	2014-15	Pooled	Net returns (Rs/ha)	C : B Ratio
Azoxystrobin 23% SC @ 0.1%	16.55 (23.96)	12.95 (21.05)	14.75 (21.24)	45.6	1897	3155	2526	727	820	773	1,28,508	1:2.26
Propiconazole 25% EC @ 0.1%	19.17 (25.90)	13.40 (21.46)	16.29 (21.23)	39.9	1769	2937	2353	654	891	773	1,17,668	1:2.22
Kresoxim methyl 44.3% SC @ 0.1%	19.15 (25.93)	9.68 (18.10)	14.42 (21.03)	46.8	1795	3137	2466	653	904	778	1,24,848	1:2.25
Pyraclostrobin + Metiram 60% WG @ 0.2%	12.92 (21.00)	5.85 (13.98)	9.39 (19.94)	65.4	2050	2835	2442	842	942	892	1,23,864	1:2.26
Carbendazim 50% WP @ 0.05%	13.40 (21.43)	5.80 (13.91)	9.60 (19.92)	64.6	1946	2810	2378	727	925	826	1,20,560	1:2.26
Untreated check	26.95 (31.25)	27.28 (31.46)	27.12 (31.36)	-	1743	2719	2231	587	781	684		
SEm ±	0.77	0.44	0.18	-	85.64	158.13	162.41	43.14	26.85	15.10		
CD (p=0.05%)	2.32	1.33	0.51	-	NS	NS	NS	130.01	80.91	43.62		
S x T interaction SEm ±	-	-	0.25	-	-	-	229.68	-	-	21.36		
CD (p=0.05%)	-	-	0.73	-	-	-	NS	-	-	61.68		

Figures in parentheses are angular transformed values Economics based on two sprays of each fungicide, first at disease appearance and another after fifteen days

methyl (2466 kg/ha), pyreclostrabin + metiram (2442 kg/ha), carbendazim (2378 kg/ha) and propiconazole (2353 kg/ha). There was no significant difference of cured leaf yield between the treatments. However, as regards grade index the highest was recorded in pyraclostrobin + metiram 60% WG @ 0.2% (892) followed by carbendazim 50% WP @ 0.05% (826) and kresoxim methyl 44.3% SC @ 0.1% (778) which were significantly superior compared to control (684).

Frog eye spot is known to adversely affect the quality of leaf rather than the quantity which is reflected in the present experiment. Net returns were the highest (Rs. 1,28,508/ha) in azoxystrobin followed by kresoxim methyl (Rs. 1,24,848/ha), pyraclostrobin + metiram (Rs. 1,23,864/ha), carbendazim (Rs. 1,20,560/ha) and propiconazole (Rs. 1,17,668/ha). However, the C:B ratio was found to be the highest (1:2.26) and same for all the three treatments viz., pyraclostrobin + metiram, carbendazim and azoxystrobin (Table 2).

From the experimental results based on the *in vitro* studies, PDI in the field crop, yield parameters, particularly grade index and economics of different treatments, either pyraclostrobin + metiram 60% WG @ 0.2% or carbendazim 50% WP @ 0.05% can be used for the management of frog eye leaf spot disease caused by *C. nicotianae* in FCV tobacco field crop (Prakesh,2007)

The present results are in agreement with the findings of Patel *et al.* (2000, 2002, 2013), Shamarao Jahagirdar and Hundekar (2010) suggested the use of carbendazim (0.05%) and propiconazole (0.1%) for the management of frog eye leaf spot disease. Strobilurin and metiram were also effective for control of *Cercospora* spp. in various other crops (Twumasi, 1993; Duvenhage, 2002; Anesiadis *et al.* 2003;Sarkar ; Chowdhury, 2005).

ACKNOWLEDGEMENT

The authors are thankful to the Director, ICAR-Central Tobacco Research Institute, Rajahmundry, Andhra Pradesh for providing facilities to take up this study.

REFERENCES

Anesiadis, T., Karaoglanidis, G. S. and Tzavella-Klonari, K. 2003. Protective, curative, and eradicant activity of the strobilurin fungicide azoxystrobin against *Cercospora beticol*a and *Erysiphe betae*. *J of Phytopathol* **151**:647-651.

Duvenhage, J A. 2002. Evaluation of new generation fungicides for control of *Cercospora* spot on avocado fruit. *South African Avocado Growers' Association Yearbook*. **25**:11-14.

Lucas, G B.1975. *Diseases of tobacco*. Biological Consulting Associates. 305 pp.

Nene, Y. L. and Thapliyal, P. N. 2000. *Fungicides in plant disease control (III edition).* Oxford and IBH publishing Co. Pvt. Ltd. New Delhi. 691pp.

Patel, B. N., Patel, H. R., Patel, P. M., Bhatt, N. A., Patel, K. D., Patel, J. G and Patel , S. T,. 2002. Integrated management of nematodes, damping-off and frog-eye leaf spot diseases in bidi tobacco nursery. *Tob. Research.* **28**: 24-30.

Patel, H. R., Joshi, K . R., and Sharma, I. P., 2013. Integrated disease management in Bidi tobacco nursery. *Indian J of Nematology.* **43**:156-159.

Patel, H. R.,, Patel, B. N.,, Patel, K. D., Pate, P. M., Bhatt, N. A., Patel, J. G. and Patel, S. T., 2000. Integrated management of nematodes, damping-off and frog eye spot in bidi tobacco nursery through organic manures, soil solarization and fungicides (Abstr.). *J. Mycol. Pl. Pathol.* **30**: 257.

Prakash, M. 2007. *Studies on frog eye leaf spot of bidi tobacco caused by Cercospora nicotianae* EII. & Eve. M. Sc. (Ag) thesis submitted to University of Agricultural sciences, Dharwad. 44pp.

Ruppel, E. G., and Petersen, S.J,. 1977. Effect of Benomyl on *in vitro* and *in vivo* Biology of Benomyl tolerant strains of *Cercospora beticol*a. *J of American Society of Sugar Beet Technologists.* **19**:233-239.

Sarkar, S .C. and Chowdhury, A. K., 2005**.** Performance of metiram 70% WDG (dithiocarbamate) on the infection and yield loss associated with tikka disease of groundnut(*Arachis hypogaea* L.) in West Bengal.*J. Mycopathol. Res*. **43**:63-65.

Shamarao, Jahagirdar and Hundekar, A. R. 2010. Management strategies against frog eye leaf spot pathogen (*Cercospora nicotianae*) in India**.** *Indian Phytopathol.* **63**: 63-65.

Sukhatme , P . V. and Amble, A . N. 1985. *Statistical methods for Agricultural workers*. Publication and Information Div., ICAR, New Delhi. 553 pp.

Twumasi, J. K. 1993**.** Field performance of some selected fungicides in the control of *Cercospora* leaf spot disease of groundnut (*Arachis hypogae* L.) in Ghana. *Ghana. Jnl. Agric. Sci.* **24-27**, 105-111.

Wheeler ,B , E . J. 1969. *An introduction to plant diseases*. John Wiley and Sons Ltd., London. 301pp.