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Frog Eye Leaf Spot Disease of FCV Tobacco Caused by *Cercospora nicotianae in* Southern Districts of Karnataka

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Survey on the disease in the field showed the extent of *Cercospora* leaf spot disease affecting the crop and quality of the leaves in different locations which was widespread particularly in intermitted rainy season / high moisture conditions, cloudy weather and incidence and severity of disease was more in Chikamagalur district followed by Davanagere and Shivamogga districts. Among the tested fungicides, *in vitro* hexaconazole, carbendazim were superior, in inhibiting the mycelial growth of the fungus. Where as *in vivo* carbendazim, hexaconazole and propiconazole at 0.1 per cent were found effective in managing the disease and recorded higher yield of 11.86, 7.92 and 6.96 tons per ha respectively.

Keywords: Frog Eye leaf spot disease, Tobacco, *Cercospora nicotianae*, Karnataka.

Tobacco (*Nicotiana tabacum* L.) belongs to the family Solanaceae, is believed to be introduced into India from its native Central America by Portuguese in 1603. It is a major commercial crop of India, grown throughout the country. India is one of the principal tobacco producing countries of the world and has attained its commercial importance in India. Successful cultivation of tobacco in recent years has met with different problems such jas pests and diseases. Among the various fungal diseases, *Cercospora* leaf spot is one of the most serious diseases of tobacco which reduces leaf quality and alkaloid centents to a greater extent. . The frog eye leaf spot disease of tobacco caused by *Cercospora nicotianae* has been reported for the first time in India by Vasudeva in 1963 from Patansagar (M.P).In the present investigation various aspects on Frog eye lreaf spot of tobacco (*Nicotiana tabacum* L.) was undertaken during the period 2014 to 2015 with reference to survey and surveillance of disease, *In vitro* and *In vivo* management of disease by fungicides.

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MATERIALS AND METHODS

Survey and surveillance on incidence of frog eye leaf spot disease of FCV tobacco in Sorthern Karnataka

A roving survey was conducted to know the per cent incidence of frog eye leaf spot disease in FCV tobacco growing areas of Shivamogga, Davanagere and Chikkamagalur districts during 2014-15. Survey was taken up for four months starting from June to September. In each taluka's three villages were selected and three fields in each

village were considered for survey. In each location five tobacco plants were randomly scored using the following formula other worker[6].

$$PDI = \frac{\text{Sum of numerical ratings}}{\text{Total number of leaves examined} \times \text{Maximum grade value}} \times 100$$

In vitro* evaluation of different fungicides against *C. nicotianae

The efficacy of five systemic and four non-systemic and four combi-products fungicides were tested against *C. nicotianae* for radial growth inhibition on the potato dextrose agar media using poisoned food technique under *in vitro* condition viz., Hexaconazole, Propiconazole, Tricyclazole, Thiophanate methyl, Carbendazim, Mancozeb, Chlorothalonil, Captan, Zineb, Hexaconazole 4% +Zineb 68% WP (Avatar), Tricyclazole 4% +Mancozeb 62 % WP(Merger), Tebuconazole 50% + Trifloxystrobin 25% (Nativo G) ,Carbendazim-12% + Mancozeb-63%(Companion) were assyed.The non-systemic fungicides and combi product were tried at 125, 250, 500 and 1000 ppm concentration, whereas systemic fungicides were tried at 100, 200, 400 and 600 ppm concentrations. The study was conducted at Plant Pathology Department, UAHS, Shivamogga during 2013-14.The quantity of fungicides was calculated for 100 ml medium separately. The requisite quantity of fungicides was added to each flask at 45 °C the fungicides were thoroughly mixed before solidification and poured into sterilized petri plates. The mycelia disc of 5mm diameter of nine days old culture was cut with the help of sterile cork borer. Each disc was transefered aseptically to the centre of each petri plate, already poured with poisoned medium. The PDA plates without fungicides were also inoculated and maintained as control. The plates were incubated at room temperature (27 ±1°C) for 12 days. Five replications per treatment were maintained. The observations on colony growth recorded until petriplate in control treatment was fully covered with mycelia growth and calculated percent inhibition by using the formula[5].

Evaluation of different fungicides against *C. nicotianae*

A field experiment were carried out at the Zonal Agriculture and Horticultural Research Station (ZAHRS) Navile, Shivamogga, University of Agricultural and horticultural Sciences, Shivamogga, Karnataka. The efficacy of four systemic and two non-systemic fungicides was evaluated. The experiment was conducted in randomized block design with seven treatments and three replications with cultivar KST-19. The details of the treatments are given here under.

S. No	Treatment details	Concentration(per cent)	Trade names
T1	Hexaconazole 5% EC	0.1	Contaf
T2	Propiconazole 25% EC	0.1	Tilt
T3	Carbendazim-12% + Mancozeb-63%	0.2	Companion
T4	Tebuconazole 50% + Trifloxystrobin 25%	0.05	Nativo G
T5	Mancozeb 75WP	0.2	Dithane M-45
T6	Carbendazim	0.1	Bavistin
T7	Control		

Plot size of 3.4 x 2.8 m was maintained per treatment. The transplanting of tobacco was taken up on 29.03.2014. First spray was taken up immediately after disease appearance followed by another two spray at 10-12 days interval.

RESULTS AND DISCUSSION

Survey and surveillance on incidence of frog eye leaf spot disease of FCV tobacco in Sorthern Karnataka

Results of the survey revealed that, leaves were more vulnerable to the attack by *Cercospora nicotianae* more disease severity on leaves, irrespective of season, location and variety. The data presented in (Table 1) revealed that among three districts surveyed, maximum percent disease index was recorded in Chikamagaluru (28 %) followed by Davanagere (24 %) district, However the least severity was recorded in Shivamogga (14.66 %) district. Taluk wise severity of frog eye leaf spot of tobacco surveyed during 2014-15 exhibited that maximum disease severity of 28 PDI was recorded in Tarikere taluk followed by Honnali (24 PDI) and Shivamogga (16 PDI). Least disease severity of 14.66 PDI was found in Shikaripura taluk.

The present findings are also in conformity with the worker[2], who reported that the September and October months are favourable period for frog eye leaf spot, recording a mean incidence of 13.05 per cent and 12.06 per cent irrespective of locations respectively. The villages Akkol and Aadi are

Table 1. Survey and surveillance on incidence of frog eye leaf spot disease of FCV tobacco in Sorthern Karnataka

S. No.	District	Taluk	Village	PDI
1	Davanagere	Honnali	Chattanahally	24.00
			Jeenahally	20.00
			Palavanahally	28.00
			Mean	24.00
2	Chikmagaluru	Tarikere	Belenahalli	32.00
			Nandhi	28.00
			Nandihosahally	24.00
			Mean	28.00
3	Shivamogga	Shivamogga	Byranakoppa	20.00
			Kallagangur	16.00
			mallapura	12.00
			Mean	16.00
		Shikaripura	Jakkinakoppa	24.00
			Old joga	12.00
			Beeranahally	08.00
			Mean	14.66

* Per cent disease index

Table 2(a). *In-vitro* evaluation of systemic fungicides against *C nicotianae*

S. No	Fungicides	Trade name	(%) Inhibition over control Concentration (ppm)				Mean
			100	200	400	600	
1	Hexaconazole 5% EC	Contaf	100 (90.00)*	100 (90.00)	100 (90.00)	100 (90.00)	100 (90.00)
2	Propiconazole 25% EC	Tilt	26.01 (26.01)	100 (90.00)	100 (90.00)	100 (90.00)	81.50 (74.00)
3	Tricyclazole 75 % WP	Beam	30.92 (34.13)	31.54 (33.88)	35.38 (36.26)	43.08 (41.02)	35.23 (36.32)
4	Thiophanate methyl 70 % WP	Roko	66.92 (54.70)	67.69 (55.68)	69.85 (56.82)	72.31 (58.25)	69.19 (56.36)
5	Carbendazim 50 % WP	Bavistin	69.46 (69.46)	100 (90.00)	100 (90.00)	100 (90.00)	92.36 (84.87)
6	Control		90.00 (0.0)	90.00 (0.0)	90.00 (0.0)	90.00 (0.0)	90.00 (0.0)
	Mean		58.78 (46.01)	79.72 (67.45)	81.04 (68.27)	83.07 (69.82)	75.65 (62.89)

*Figures in parentheses are angular transformations

	S.Em±	CD @ 1 %
Fungicide (F)	0.07	0.27
Concentration (c)	0.06	0.24
F x C	0.14	0.55

considered as most severe zone and hot spots for frog eye leaf spot in Nipani. Avoidable loss due to this disease has been estimated to the tune of 21 per cent in bidi tobacco field under normal monsoon conditions in Gujarath[3].

Table 2(b). *In-vitro* evaluation of Non-systemic fungicides against *C.nicotinae*

S. No	Fungicides	Trade name	(%) Inhibition over control Concentration (ppm)				Mean
			100	200	400	600	
1	Mancozeb 75WP	Dithane M-45	65.89 (64.38)*	74.44 (63.30)	79.81 (59.63)	81.30 (54.27)	75.36 (60.40)
2	Chlorothalonil 75% WP	Kavach	58.52 (55.77)	68.33 (66.85)	81.11 (64.28)	84.52 (49.93)	73.12 (59.21)
3	Captan 50% WP	Captaf	72.96 (58.74)	77.33 (61.58)	81.33 (64.41)	86.00 (68.04)	79.41 (63.19)
4	Zineb 80 % WP	Dithane Z-78	37.48 (51.75)	61.67 (37.75)	70.81 (57.35)	75.33 (60.22)	61.32 (51.77)
5	Control		90.00 (0.0)	90.00 (0.0)	90.00 (0.0)	90.00 (0.0)	90.00 (0.0)
Mean			71.06 (57.66)	69.79 (37.75)	76.93 (61.42)	71.44 (58.11)	72.30 (58.64)

*Figures in parentheses are angular transformations

	S.Em±	CD @ 1 %
Fungicide (F)	0.51	1.99
Concentration (c)	0.51	1.99
F x C	1.02	3.98

Table 2(c). *In-vitro* evaluation of Combi-products fungicides against *C.nicotinae*

S. No	Fungicides	Trade name	(%) Inhibition over control Concentration (ppm)				Mean
			100	200	400	600	
1	Carbendazim-12% + Mancozeb-63%	Companion	76.63 (61.09)*	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	94.16 (82.77)
2	Tebuconazole 50% + Trifloxystrobin 25%	Nativo G	91.04 (72.60)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	97.76 (85.65)
3	Tricyclazole 4% +Mancozeb 62 % WP	Avatar	71.80 (57.93)	74.15 (60.22)	75.33 (59.44)	90.00 (71.57)	77.82 (62.29)
4	Hexaconazole 4% +Zineb 68% WP	Merger	74.85 (61.88)	77.78 (68.83)	84.30 (59.90)	86.96 (60.66)	80.96 (62.81)
5	Control		90.00 (0.0)	90.00 (0.0)	90.00 (0.0)	90.00 (0.0)	90.00 (0.0)
Mean			78.58 (63.37)	87.98 (77.26)	89.90 (74.84)	94.24 (78.05)	87.65 (73.38)

*Figures in parentheses are angular transformations

	S.Em±	CD @ 1 %
Fungicide (F)	0.12	0.47
Concentration (c)	0.12	0.47
F x C	0.24	0.95

In vitro* evaluation of different fungicides against *C. nicotianae

Five systemic, four non-systemic fungicides and four combi-products fungicides were screened against *C. nicotianae* by poison food technique. The data presented in (Table 2a, 2b and 2C) revealed that fungicides were found significantly superior in reducing the growth of fungus. Among non-systemic (four combi) fungicides, captan and Tebuconazole 50% + Trifloxystrobin 25% (Nativo G) at 125 ppm concentration showed 72.96 and 91.04 per cent inhibition of mycelial growth of fungus followed by Carbendazim-12% + Mancozeb-63% (Companion) with 76.63 per cent and least inhibition of mycelial growth was recorded in Zineb (37.48 per cent) with 125 ppm concentration. Systemic fungicides, Hexaconazole showed 100 per cent inhibition of mycelialll growth of fungus and was followed by carbendazim (69.46%) at 100 ppm concentration while, least per cent inhibition of mycelial growth was recorded in trycyclazole (30.92). The effectiveness of the triazole fungicides like propiconazole may be attributed to their interfeance with the biosynthesis of fungal sterols and inhibit the ergosterol biosynthesis. These results are conformity with findings of other workers [2,4] showed Hexaconazole, carbendazim and propiconazole inhibited mycelial growth of *C.nicotianae*.

Evaluation of different fungicides against *C. nicotianae*

The results after two sprays revealed that, lowest disease severity of 26.00 PDI was observed in carbendazim 0.1 per cent which was significantly superior over other treatments followed by hexaconazole and propiconazole with a PDI of 29.15 and 31.75 at 0.1 per cent. The other

Table 3. Evaluation of different fungicides against *C. nicotianae*

S. No	Treatments	Concentration (%)	PDI	TGE * (Kg/ha)	C:B ratio
T1	Hexaconazole 5 % EC. (Contaf)	0.1	29.15	792	1:1.9
T2	Propiconazole 25 % EC. (Tilt)	0.1	31.75	696	1:2.0
T3	Carbendazim – 12 % + Mancozeb – 63%(Companion) WG	0.2	42.25	576	1:1.0
T4	Trifloxystrobin 25 % and Tebuconazole 50 %WG (Nativo)	0.05	36.25	452	1:1.0
T5	Mancozeb 75 % WP (Dithane M-45)	0.2	32.86	666	1:1.2
T6	Carbendazim 50 % WP (Bavistin)	0.1	26.00	1186	1:3.2
T7	Control		67.25	210	1:-0.09
S.Em ±C.D. 5%			2.08	3.11	
			6.40	9.25	

Top grade equivalent

fungicides *viz.*, Carbendazim-12% + Mancozeb-63% (0.2 %), Tebuconazole 50% + Trifloxystrobin 25% (0.05%) and Mancozeb 75WP (0.2%) were found less effective (Table 3). Maximum disease severity *i.e.*, 67.25 PDI was recorded in untreated control. Finally concluded as carbendazim at 0.1 per cent concentration was significantly superior over other fungicides, where as hexaconazole and propiconazole at 0.1 per cent remained statistically on par with each other. The similar results were reported other worker[1] identified that the Carbendazim, Propiconazole and Hexaconazole were highly effevtive against frog-eye leaf spot of bidi tobacco in Karnataka. Among non-systemic and combi fungicides, combi product like Tebuconazole 50% + Trifloxystrobin 25% (Nativo) at 0.05 percent concentration was significantly superior where as Companion at 0.2% and mancozeb were less effective. The results are in agreement with other worker[2].

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