International Journal of Agricultural Sciences
Volume **14** | Issue 1 | January, 2018 | 225-228 ■ e ISSN-0976-5670
☞ **DOI:10.15740/HAS/IJAS/14.1/225-228**
Visit us : ***www.researchjournal.co.in***

RESEARCH PAPER

Studies on evaluation of fungicides against *Curvularia lunata* in maize

Kotramma C. Adaangadi*, S. I. Harlapur[1], Savita Chakrasali[1] **and** Basamma R. Hadimani[1]
Regional Research Station (S.D.A.U.), BHACHAU (GUJARAT) INDIA
(Email : kotramma.addangadi@gmail.com)

Abstract : Maize is an important cereal crop of India. Maize not only an important human nutrient but also a basic element of animal feed and raw material for manufacture of many industrial products. Recently the crop is severely affecting with Curvularia leaf spot of maize caused by *Curvularia lunata* (Wakker) Boedijn and it is endemic in the maize growing areas of northern Karnataka. Fungicides were evaluated by poison food technique. Among the five contact fungicides tested at three concentrations, mancozeb 75% WP showed cent per cent inhibition. Among all the systemic fungicides tested triazoles were found to be a most effective in inhibiting the mycelial growth of the fungus at all the concentrations. The combiproduct fungicides *viz.*, carboxin 37.5% + thiram 37.5% WS, captan 70% + hexaconazole 5% WP, iprovalicarb 5.5% + propineb 61.25% WP and pyraclostrobin 13.3% + epoxiconazole 5% WP gave 100 per cent inhibition at all the concentrations tested.

Key Words : *In vitro*, Fungicides, *Curvularia lunata*, Maize, Evaluation

View Point Article : Adaangadi, Kotramma C., Harlapur, S.I., Chakrasali, Savita and Hadimani, Basamma R. (2018). Studies on evaluation of fungicides against *Curvularia lunata* in maize. *Internat. J. agric. Sci.*, **14** (1) : 225-228, **DOI:10.15740/HAS/IJAS/14.1/225-228.**

Article History : Received : 07.03.2017**; Revised :** 07.12.2017**; Accepted :** 19.12.2017

INTRODUCTION

Maize (*Zea mays* L.) is an important cereal crop belonging to the family Poaceae. Maize not only an important human nutrient but also a basic element of animal feed and raw material for manufacture of many industrial products. It is also being recently used as biofuel and also for extraction of starch. Maize is versatile crop grown over a range of agro climatic conditions. It is cultivated in tropics, subtropics and temperate regions under irrigated and rainfed conditions. Globally maize occupies an area of 174.2 mha with the production of 852 mt and productivity accounts for 4,890 kg/ ha. In India maize occupies an area of 9.42 mha, with the production of 22.26 mt and average productivity is 2,583 kg/ha. In Karnataka maize occupies an area of 13.82 lakh ha with the production of 39.84 lakh t and average productivity is 2,883 kg/ha (Anonymous, 2014). In India, about 50 to 60 per cent of maize production is consumed directly as food, 30 to 35 per cent goes for poultry, piggery

*** Author for correspondence:**
[1]Department of Plant Pathology, College of Agriculture, University of Agricultural Sciences, DHARWAD (KARNATAKA) INDIA

and fish meal, 10 to 12 per cent in wet milling industry *e.g.*, starch and oil and about 3 per cent in dry milling for traditional requirements like *Dalia* and *Sattu* and other food industry such as corn bread and corn chips, brewery one per cent and as seed, one per cent. Karnataka, Andra Pradesh, Uttar Pradesh, Bihar, Rajasthan, Madhya Pradesh and Punjab are the leading states growing maize on large scale.

Maize is subjected to as many as 112 diseases on global basis. In India there is record of 35 diseases. Curvularia leaf spot of maize was earlier considered to be of minor importance. It has now increased all over the maize growing areas in India and is reported to cause leaf spot in maize (Choudhary *et al*., 2011). The incidence of this disease was first reported in India as *Curvularia clavata* from Varanasi region of Uttar Pradesh. Symptoms start as minute, chlorotic, pinhead sized translucent spots on the leaf surface. Subsequently the spots increases in size and necrosis start from the centre (Mandokhot and Basu Chaudhary, 1972). In Karnataka the disease was reported for the first time in 2008 (Anonymous, 2008). Disease is causing 20-60 per cent yield loss hence, adaptation of effective management strategies is necessary. Hitherto no systematic work has been done on this disease. Hence, *in vitro* evaluation of fungicides provides useful and preliminary information regarding efficacy of fungicides against pathogen within a shortest period of time and therefore, serves as a guide for field testing. Sumangala *et al*. (2008) reported that highest per cent inhibition of mycelial growth of *Curvularia* in rice was obtained with mancozeb at 0.2 per cent, difenconazole (98.8%) and propiconazole (98.10%) at 0.1 per cent concentration tested under *in vitro* condition.

MATERIAL AND METHODS

The present study was conducted at Department of Plant Pathology, College of Agriculture, Dharwad, University of Agricultural Sciences, Dharwad - 580 005, India during 2014-15. Twenty one fungicides were tested under *in vitro* for their efficacy by following poison food technique against *C. lunata*. The pathogen was grown on PDA medium in Petriplates for ten days prior to setting the experiment. Fungicide suspension was prepared in PDA by adding required quantity of fungicides concentration. Twenty ml of poisoned medium was poured in each of the sterilized Petriplates. Mycelial disc of 5 mm was taken from the periphery of ten days old culture and placed in the center and incubated at 28 ± 2^0C till growth of the fungus touched the periphery in control plate. Suitable checks were maintained without the addition of any fungicide, three replications were maintained for each treatment. The colony diameter of the fungus was measured in two directions and average was worked out. The per cent inhibition of growth was calculated by using the formula given by Vincent (1947).

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

where,

I = Per cent inhibition of mycelium

C = Growth of mycelium in control

T = Growth of mycelium in treatment.

RESULTS AND DISCUSSION

Efficacy of contact, systemic and combiproduct fungicides were tested at different concentrations by poison food technique as explained in material and methods. The per cent inhibition of the growth of the

Table 1: *In vitro* evaluation of contact fungicides against *Curvularia lunata*

Fungicide	Per cent inhibition of mycelial growth			Mean
	Concentration (%)			
	0.1	0.2	0.3	
Captan 50% WP	73.70 (59.13)*	75.19 (60.10)	78.89 (62.63)	75.92 (60.62)
Chlorothalonil 75% WP	36.67 (37.25)	44.81 (42.01)	46.30 (42.86)	42.49 (40.70)
Mancozeb 75% WP	100.00 (89.96)	100.00 (89.96)	100.00 (89.96)	100.00 (89.96)
Propineb 70% WP	77.41 (61.60)	85.56 (67.65)	100.00 (89.96)	87.65 (73.07)
Zineb 70% WP	49.63 (44.77)	63.30 (54.49)	76.67 (61.10)	63.20 (53.46)
Mean	67.48 (58.54)	73.77 (62.84)	80.37 (69.30)	
Fungicide	F	C	F×C	
S.E.±	0.31	0.23	0.34	
C.D. (P=0.01)	0.98	0.78	1.12	

* Arcsine transformed values

test fungus at different concentrations over control was computed. The results pertaining to the effect of fungicides on inhibition of *Curvularia lunata* are presented in Table 1, 2 and 3.

Results from the Table 1 revealed that all the test fungicides significantly inhibited mycelial growth of the fungus. Among different concentration, highest inhibition of 80.37 per cent was revealed at 0.3 per cent concentration, whereas least was at 0.1 per cent (67.48%).

Among the different contact fungicides tested mancozeb 75% WP recorded cent per cent inhibition (100 %) followed by propineb 70% WP (87.65%) and least inhibition was recorded in chlorothalonil 75% WP (42.49%). In the interaction of fungicide × concentration, while mancozeb 75% WP at all the tested concentration and propineb 70% WP at 0.3 per cent concentration resulted in absolute (100%) inhibition of *C. lunata*, least inhibition of 36.67 per cent was observed with chlorothalonil 75% WP at 0.1 per cent concentration. Sumangala *et al*. (2008) reported that highest per cent inhibition of mycelial growth was obtained with mancozeb at 0.2% concentration tested under *in vitro* condition. Harlapur *et al*. (2007) reported that mancozeb is effective against *Exserohilum turcicum* causing turcicum leaf blight of maize.

Table 2: *In vitro* evaluation of systemic fungicides against *Curvularia lunata*

Fungicide	Per cent inhibition of mycelial growth			Mean
	Concentration (%)			
	0.05	0.1	0.15	
Difenconazole 25% EC	90.00 (71.55)*	93.70 (75.45)	99.26 (87.11)	94.32 (78.03)
Hexaconazole 5% EC	100.00 (89.96)	100.00 (89.96)	100.00 (89.96)	100.00 (89.96)
Kresoxim-methyl 44.3% SC	1.85 (7.73)	15.93 (23.51)	36.67 (37.25)	18.15 (22.83)
Myclobutanil 10% WP	100.00 (89.96)	100.00 (89.96)	100.00 (89.96)	100.00 (89.96)
Propiconazole 25% EC	100.00 (89.96)	100.00 (89.96)	100.00 (89.96)	100.00 (89.96)
Pyraclostrobin 20% WG	38.15 (38.13)	42.59 (40.70)	51.11 (45.62)	43.95 (41.48)
Tebuconazole 250% EC	100.00 (89.96)	100.00 (89.96)	100.00 (89.96)	100.00 (89.96)
Trifloxystrobin 50% WG	1.90 (7.73)	8.15 (16.57)	16.29 (23.80)	8.78 (16.03)
Mean	66.48 (60.62)	70.04 (64.50)	75.41 (69.20)	
Fungicide	F	C	F×C	
S.E.±	0.51	0.33	0.72	
C.D. (P=0.01)	1.68	1.12	2.17	

* Arcsine transformed values

Table 3: *In vitro* evaluation of combiproduct fungicides against *Curvularia lunata*

Fungicide	Per cent inhibition of mycelial growth			Mean
	Concentration (%)			
	0.1	0.2	0.3	
Captan 70% + Hexaconazole 5% WP	100.00 (89.96)*	100.00 (89.96)	100.00 (89.96)	100.00 (89.96)
Carbendazim 12% + Mancozeb 63% WP	58.15 (49.67)	65.93 (54.27)	88.15 (69.85)	70.73 (57.93)
Carboxin 37.5% + Thiram 37.5 %WS	100.00 (89.96)	100.00 (89.96)	100.00 (89.96)	100.00 (89.96)
Hexaconazole 4% + Zineb 68% WP	92.96 (74.60)	100.00 (89.96)	100.00 (89.96)	97.65 84.84
Iprovalicorb 5.5% + Propineb 61.25% WP	100.00 (89.96)	100.00 (89.96)	100.00 (89.96)	100.00 (89.96)
Metiram 55% + Pyraclostrobin 5% WG	86.30 (68.31)	90.00 (71.55)	90.37 (71.92)	88.89 (70.59)
Pyraclostrobin 13.3% + Epoxiconazole 5% WP	100.00 (89.96)	100.00 (89.96)	100.00 (89.96)	100.00 (89.96)
Tebuconazole 50% + Trifloxystrobin 25% WG	88.15 (69.85)	90.37 (71.92)	91.85 (73.42)	90.12 (71.73)
Mean	90.65 (77.78)	93.28 (80.94)	96.29 (83.12)	
Fungicide	F	C	F×C	
S.E.±	0.41	0.29	0.53	
C.D. (P=0.01)	1.38	0.98	1.77	

* Arcsine transformed values

Results of systemic fungicides revealed that (Table 2), among the different concentrations highest inhibition of 75.41 per cent was recorded at 0.15 per cent concentration, whereas least at 0.05 per cent (66.48%). Among different systemic fungicides tested myclobutanil 10% WP, hexaconazole 5% EC, tebuconazole 250% EC and propiconazole 25% EC recorded cent per cent inhibition followed by, difenconazole 25% EC with 94.32 per cent inhibition and least (8.78%) was observed with Trifloxystrobin 50% WG.

In the interaction of fungicide × concentration, while hexaconazole 5% EC, myclobutanil 10% WP, propiconazole 25% EC and tebuconazole 250% EC resulted in absolute (100%) inhibition of *C. lunat* a at all the concentrations, least inhibition was observed with kresoxim-methyl 44.3% SC (1.85%) and trifloxystrobin 50% WG (1.90%) at 0.05 per cent concentration. Among all the systemic fungicides tested triazoles were found to be a most effective in inhibiting the mycelial growth of the fungus at all the concentrations. Strobulurin fungicides were showed least inhibition of the mycelial growth.Similar observations were recorded by Sumangala *et al*. (2008) have found difenconazole (98.8%) and propiconazole (98.10%) very effective at 0.1 per cent concentration.

From the Table 3 results revealed that, among the different concentrations tested for combiproduct fungicides, while highest mycelial inhibition of 96.29 per cent was observed at 0.3 per cent concentration, least (90.65%) was revealed at 0.1 per cent concentration. Among the different cobmiproducts tested cent per cent inhibition was recorded in Captan 70% + hexaconazole 5% WP, carboxin 37.5% + thiram 37.5% WS, iprovalicorb 5.5% + propineb 61.25% WP and pyraclostrobin 13.3% +epoxiconazole 5% WP followed by hexaconazole 4% + zineb 68% WP with 97.65 per cent inhibition and least (70.73%) was observed with carbendazim 12% + mancozeb 63% WP.

In the interaction between fungicide and concentration, while complete inhibition of *C. lunata* was found in captan 70% + hexaconazole 5% WP, carboxin 37.5% + thiram 37.5% WS, iprovalicorb 5.5% + propineb 61.25% WP and pyraclostrobin 13.3% + epoxiconazole 5% WP at all the concentrations, hexaconazole 4% + zineb 68% WP resulted in complete inhibition at 0.2 and 0.3 per cent concentrations. Least inhibition of 58.15 per cent was observed in carbendazim 12% + mancozeb 63% WP at 0.1 per cent concentration. Indicating the selectivity of fungicide against *C. lunata*.). Hulagappa (2012) reported that highest per cent inhibition of mycelial growth was observed with hexaconazole 4% + zineb 68% WP on *Drechslera maydis* causing maydis leaf blight of maize.

REFERENCES

Anonymous (2008). Research highlights *Kharf*-2008. Zonal Research and Extension Advisory Council and Zonal Research and Extension Formulation Committee Meeting, University of Agricultural Sciences, Dharwad (KARNATAKA) INDIA.

Choudhary, O. P., Amit, T., Bunker, R. N. and Kusum, M. (2011). A new record on involvement of *Curvularia andropogonis* in causing leaf spot on maize in India. *J. Mycol. Pl. Pathol.*, **41** (1) : 123-124.

Harlapur, S. I., Kulkarni, M. S., Yashoda, H. and Srikant, K. (2007). Variability in *Exserohilum turcicum* (Pass) Leonard and Suggs., causal agent of turcicum leaf blight of maize. *Karnataka J. Agric. Sci.*, **20** (3): 665-666.

Hulagappa (2012). Studies on maydis leaf blight of maize caused by *Drechslera maydis* (Nisikado) Subram and Jain. M.Sc. (Ag.) Thesis, University of Agricultural Sciences, Dharwad, KARNATAKA (INDIA).

Mandokhot, A. M. and Basu Chaudhary, K. C. (1972). A new leaf spot of maize incited by *Curvularia clavata*. *Netherland J. Pl. Pathol*., **78** : 65-68.

Sumangala, K., Patil, M. B., Nargund, V. B. and Ramegowda (2008). Evaluation of fungicides, botanicals and bioagents against *Curvularia lunata*, a causal agent of grain discolouration in rice. *J. Pl. Dis. Sci.*, **3**(2): 159-164.

Vincent, J. M. (1947). Distortion of fungal hyphae in presence of certain inhibitors. *Nature*, **159** (4051): 850.

WEBLOGRAPHY

Anonymous (2014). *http://agricoop.nic.in/agristatistics.htm.*