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In Vitro and *In Vivo* Evaluation of Fungicides against Leaf Spot of Zinnia Caused by *Cercospora zinniae* Ell. and Mart

Zinnia (*Zinnia elegans* Jacq.) is known to suffer from leaf spot caused by *Cercospora zinniae* Ell. and Mart. especially during *kharif* season. The cultivated variety is quite susceptible and hence there was an urgent need to develop effective control measures. Therefore, investigations were carried out to search for effective fungicides.

The "poisoned food technique" (Sharvelle, 1961) was adopted for the bioassay of various fungicides. The fungicides tested were, *viz.* copper oxychloride (Blitox–50) 50 per cent, WP; chlorothalonil (Kavach) 75 per cent EC; difolatan 80 per cent WP, (captafol) Mancozeb (Dithane M–45) 75 per cent WP and ziram (Cuman–L) 27 per cent EC, carbendazim (Bavistin) 50 per cent WP, & Triadimefon (Bayleton) 27 per cent WP. Required quantity of individual fungicides was added separately to 60 ml of potato dextrose agar which was cooled to 45° C, so as to get the desired concentrations of the fungicides. Later, poisoned medium was poured into sterile petriplates and 5 mm discs from a sixteen day old culture of the fungus was placed in the centre of the agar plates. Controls were maintained by growing the pathogen on PDA plates.

Three replications were maintained for each concentration. Then, the plates were incubated at room temperature (28±1° C) for sixteen days and radial colony growth was taken when maximum growth occurred in control plates. The efficacy of fungicides

Table 1. *In vitro* evaluation of fungicides against *Cercospora zinniae*

Fungicides	Inhibition zone (mm)			
	Concentration in ppm			
	250	500	1000	2000
Carbendazim (Bavistin)	49.33	65.44	66.44	—
Copper oxychloride (Blitox–50)	—	—	46.33	55.22
Chlorothalonil (Kavach)	—	—	50.88	66.77
Difolatan (Captafol)	—	—	47.77	55.66
Mancozeb (Dithane M–45)	—	—	72.33	86.66
Triademefon (Bayletan)	36.22	44.22	48.99	—
Ziram (Cuman–L)	—	—	37.11	41.99
Mean	12.22	15.66	52.83	43.76
S.Em ±	0.93	1.12	1.90	1.17
C.D. (at 1%)	4.05	4.86	8.23	5.08

were expressed as per cent inhibition over the control which was calculated by using the formula of Vincent (1947).

Five fungicides were tested against leaf spot of zinnia under field condition during 1991 *kharif* in a randomised block design. The selected plants were thoroughly sprayed with respective fungicides after 25 days of planting. Totally, three sprays were given at an interval of 15 days. Observations were recorded by using 0–5 scale and data were analysed statistically. Per cent disease index was calculated by using the formula given by Wheeler (1969). Data on efficacy of different fungicides was determined on the basis of mean inhibition zone in each concentration of fungicide and is presented in Table 1. Mancozeb was found to be most effective at the concentration of 1000 ppm and 2000 ppm and it differed significantly from all other fungicides tested. Mancozeb inhibited 86.7 per cent of the mycelial growth at 2000 ppm. Among the systemic fungicides, carbendazim was superior and inhibited mycelial growth of 66.4 per cent at a concentration of 1000 ppm and differed significantly with the rest. This is an agreement with the results of Fajola and Alasoadura (1973) who reported that mancozeb was the best fungicide for the control of frog eye spot of tobacco. *In vitro* evaluation of fungicides provides useful preliminary information regarding efficacy of fungicides against pathogen within a shortest period of time. Under the field condition, out of five fungicides tested, mancozeb (0.2 per cent) was found to be highly effective for reduction of leaf spot and flower infection followed by carbendazim (0.1 per cent) and chlorothalonil (0.2 per cent) (Table 1). Therefore, the minimum per cent disease index was found in mancozeb (5.9 per cent) and carbendazim (13.4 per cent), in Table 2. The fungicides differed significantly among themselves. Similar observations were recorded by Raghavendra Rao and Chacko (1986); and Madhumeeta and Shyam(1989) while working with *Cercospora* leaf spot of *zinnia*. Hence, mancozeb (0.2 per cent) could be recommended for the control of leaf spot of zinnia.

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Table 2. Efficacy of different fungicides in control of *Cercospora* leaf spot of *Zinnia* under field conditions during *kharif* 1990-91

Fungicides	Per cent disease index
Carbendazim (0.1%)	13.36* (23.11)**
Chlorothalonil (0.2%)	18.26 (31.33)
Copper oxychloride (0.2%)	26.75 (44.99)
Mancozeb (0.2%)	5.94 (10.33)
Ziram (0.2%)	31.11 (51.77)
Control (water spray)	53.62 (80.44)
S.Em. ±	1.50
C.D. at 5%	4.73

* Figures indicate transformed values (arcsine)

** Figures in the parenthesis indicate original percentage

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Biological Control of *Sclerotium rolfsil* Sacc. – A Causal Agent of Stem Rot of Groundnut

Groundnut is one of the important oilseed crops grown in India. The crop suffers from many diseases; among them, stem rot caused by *Sclerotium rolfsii* Sacc. is an important disease in Karnataka. A perusal of the literature revealed that very little work has been on the biological control of this disease. Therefore, the present investigation was undertaken on this aspect to manage the disease effectively.

Seed treatment with different antagonistic organisms was taken up to evaluate their efficacy on the germination and stand of groundnut seedlings inoculated with *S. rolfsii*. Seven organisms were tested: *Aspergillus flavus* Link; *Aspergillus niger* Van Tiegh; *Bacillus subtilis* Cohn. Emend–Praz; *Pencillium chrysogenum* Thom; *Streptomyces* sp; *Trichoderma harzianum* Rifai; and *Trichoderma viride* Pers. ex Fr.

Two kg of 2 mm sieved sterilised soil was taken in earthen pots of size 10 cm x 15 cm and inoculated with giant culture of sclerotia so as to obtain four per cent inoculum in the infested soil. Ten healthy, viable, surface sterilised seeds of groundnut were dipped in respective antagonistic cultures for 30 min and ten treated seeds were sown in infested soil. The per cent mortality both as pre–emergence and post–emergence was recorded for all treatments on 10th and 30th day of inoculation respectively.

The seven antagonistic cultures were also tested for their efficacy as soil drenching: Two kg of two mm sieved sterilised soil was taken in earthen pots and inoculated with giant culture of sclerotial bodies (four per cent by w/w). Healthy, viable, surface sterilised ten seeds of groundnut were sown in the infected soil. Pots were irrigated to about 25 per cent soil moisture on oven dry basis.