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USE OF FUNGICIDE BY RHIZOSPHERE AND SOIL MYCOFLORA OF *CAPSICUM ANNUUM* L. FROM DISTRICT NASHIK, MAHARASHTRA, INDIA

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Abstract

The investigation was undertaken to study the use of fungicide (Zineb) by the rhizosphere and soil mycoflora of Nashik important crop of *Capsicum annuum* L. this is the worked of my Ph.D. thesis data. Tolerance of fungicide by the rhizosphere microflora of Chilli plants recorded from rhizosphere and soil. Most of the fungal species tolerated Zineb from rhizosphere and soil. *Aspergillus fumigates* at 150 µg/ml and *Fusarium redolens* at 100 µg/ml tolerated of higher concentration.

Key words: Fungicide, tolerance, rhizosphere, soil, fungi

Introduction

The world trade in chilli accounts for 16% of the total spice trade in the world, occupying the second position after black pepper. The major importing countries are the United Arab Emirates, European Union, Sri Lanka, Malaysia, Japan and Korea. Importance of *Capsicum annuum* L. belongs to the genus *Capsicum* under Solanaceae family. It is an important element in curries, pickles and chutneys. Oleoresin, sauce and essence are prepared from the chilli. It is used in various forms; as raw, fresh green chopped chilli; or ground to a paste, broken, split or whole form. To preserve for longer time it is sun- dried to get a 'red' coat chilli, when powdered is used in a pinch to get the desired level of pungency. *C. annuum* is important cash crop in India and is grown for its pungent fruits, which are used both green and ripe to impart pungency to the food. Green C. *annuum* is rich in vitamin A and C, minerals and protein. Dry *Capsicum annuum* are also rich in vitamin A and D. As a condiment, it has become indispensable in every Indian home. Nadkarni (1927) has reported many medicinal value of chilli. It is used with many ingredients for local remedies. The pungency is due to the oleoresin 'capsicin' contained in the skin and the septa of the fruit is grown in all parts of India covering about 7, 33,800 hectares. It is valued for its diverse commercial uses.

Dwivedi and Pathak (1981) observed that a total of 86 fungal species was isolated from the root surface of tomato plants treated with Bavistin in different stages of growth. They noted a considerable decrease in the population with variable effects on individual species at various growth periods. Tenwar and Mehrotra (1981) also observed significant decrease in the fungal population in the rhizosphere of gram treated with Benlate, Difolatan, Cereson, PCNB and Thiram. Populations of *Myrothecium* sp., *Aspergillus* sp., *Fusarium* sp. and *Penicillium* sp. remained dominant at 100 ppm of Difolatan, Benlate, PCNB and Ceresan respectively. Sullia (1969) was reported that the fungicide kitazin decreased the numbers of fungi in the rhizosphere and rhizoplane of rice. Grossbard (1976) gave a detailed account of effects of herbicides on soil microflora. Some workers have examined the survival of selected fungi isolated from certain herbicides treated soils by Goguadze (1966 and 1968). Channabasava *et al.,* (2015) studies by fungicide treatments affect the root colonization by *R. fasciculatus* and growth of Proso millet plants. Treatment with Benomyl, followed by Bavisin and Mancozeb, significantly decrease the root colonization, spore number, plant growth and grain yield of mycorrihizal plants compared with mycorrhizal plants without fungicide treatment. Deepa sonker *et al.,* (2016) was studied by Neem based (Gronim) 1% followed by *B. thuringensis* 1% were found superior to all other treatments for reduction of the bug population of red cotton bug. *Dysdercus cingulatus* after 3 and 7 days of treatment,

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higher population reduction of aphid after 15 and 30 days of treatment was recorded.

The work done on different aspects of fruit rot disease of chilli in India and abroad has been well documented, but not much information is available on this disease from this state, which is having agro climatic conditions congenial to the disease development and resulting in heavy losses in crop yield. Although the disease can be kept under check with repeated chemical sprays, but the excessive use of fungicides poses a threat due to pollution and health hazards, which thereby demand, for a safer and eco-friendly approach to manage this disease. At present chemical fungicides *viz*. mancozeb, captan, carbendazim, thiram, copper oxichloride, benlate, ziram etc. are used to manage the disease. Various pathogens like Gloeosporium ampelophagum, *Fusarium* oxysporum, Colletotichum capsici, *Pythium* sp. and *Phytophthora* sp. have been reported Gangawane (1990) to develop resistance against commonly used fungicides.

Materials and Methods

Collection of Rhizosphere and non rhizosphere soil samples:

Samples were collected from the different localities in sterilized polyethylene bags. Visits were made to all selected sites every fortnight for various visible fungal diseases. During the growing season, the plants at different growth period (30 day) were dug out, at the different places in respective fields, along with a block of soil intact around the root system, by means of a sterile spatula. The roots were slowly shaken to remove the soil adhering to them.

Isolation of fungi and Selection of medium:

The occurrence of fungi in rhizophere and non rhizosphere soil samples were studied by using the plate count technique. It is difficult to select a single suitable medium for isolation of the soil fungi because of their diverse requirements for growth in culture hence different media were tested for obtaining maximum results. Different culture media were utilized *viz.* Czapek - Dox Agar and Potato Dextrose Agar. Soil dilution and pour plate method were used for isolation of fungal pathogens. In this method rhizosphere soil from diseased plant were transferred to sterilized distilled water kept in 250 ml. conical flasks to make spore suspension. About 10 ml. of prepared Czapek - Dox agar medium at about 35°C to 45°C were poured in the petridishes. One ml. of the spore suspensions were transferred to sterilized petridishes in aseptic conditions. Petri plates were allowed to cool down and solidify and transferred to an incubator and were kept for 10th days at 25°C to 27°C. In addition to this, diseased spots were carefully taken out from surface sterilized diseased *Capsicum annuum* leaves and used for isolation of fungal pathogen.

Food Poisoning Soil Dilution (FPSD) technique:

Tolerance of Rhizosphere and Soil fungi was studied by modified food poisoning soil dilution (FPSD) technique Nene (1971), Saler and Gangawane (1981) were used for quantitative and qualitative studies of soil.

Zineb - INDOFIL Z-78	Technical Name: Zineb 75% WP	BASF India. Ltd, Mumbai

Identification of fungi: The identification of fungal organism was done by referring various monographs, research papers and other literature such as Hand book of Soil fungi Nagmani *et al.,* (2006), Barnett and Hunter (1972), Ellis (1971-1976), etc.

Results and Discussion

Use of fungicide by Rhizosphere and Soil of *Capsicum annuum* L .at 30 day growth period

Qualitative results:

In total, of 16 fungal species were recorded, of these 12 species were recorded from rhizosphere and 10 species in soil on poisoned plates. At '0' µg/ml, 16 species were recorded in rhizosphere and 14 were in the soil. 10 µg/ml Zineb was tolerated by 12 species in rhizosphere and 10 species in soil, 20 µg/ml was tolerated by 9 species in rhizosphere and 8 in soil, 50 µg/ml was tolerated by 5 species, both in rhizosphere and in soil, 100 µg/ml was tolerated by 3 species in rhizosphere and also in soil and 150 µg/ml was tolerated by 1 species both in rhizosphere and soil table 1.

At 150 µg/ml Zineb the tolerated fungal species were: *Aspergillus fumigatus* (R and S); At 100 µg/ml Zineb the tolerated fungal species were: *Aspergillus carbonarius* (R), *Aspergillus fumigatus* (R and S), *Aspergillus nidulans* (R) and *Fusarium redolens* (S); At 50 µg/ml Zineb the tolerated fungal species were: *Aspergillus carbonarius* (R and S), *Aspergillus fumigatus* (R and S), *Aspergillus nidulans* (R and S), *A. niger* (R and S) and *Fusarium moniliforme* (R and S).

The species tolerated at 20µg/ml were: *Aspergillus carbonarius* (R and S), *Aspergillus fumigatus* (R and S), *Aspergillus nidulans* (R and S), *A. niger* (R and S), *Aspergillus sclerotiorum* (R and S), *Fusarium moniliforme* (R and S), *Fusarium redolens* (R and S) and *T. viride* (R and S).

The species tolerated to 10 µg/ml were: *Alternaria*

Table 1: Number of fungal colonies tolerated to Zineb (µg/ml) for Soiland Rhizosphere at 30 day growth period of *Capsicum* annuum L.

Sr. No.	Fungal species	Control		10		20		50		100		150	
		R	S	R	S	R	S	R	S	R	S	R	S
1	*Alternaria tenius*	1	-	1	-	-	-	-	-	-	-	-	-
2	*Aspergillus carbonarius*	5	2	2	2	2	1	1	1	1	-	-	-
3	*Aspergillus flavus*	3	3	2	2	2	1	-	-	-	-	-	-
4	*Aspergillus fumigatus*	4	5	1	1	1	-	2	2	2	1	3	1
5	*Aspergillus nidulans*	4	2	2	2	1	1	1	2	1	-	-	-
6	*Aspergillus niger*	4	4	2	1	2	1	1	1	-	-	-	-
7	*Aspergillus sclerotiorum*	3	2	2	2	2	1	-	-	-	-	-	-
8	*Cladosporium herbarum*	2	2	-	-	-	-	-	-	-	-	-	-
9	*Fusarium moniliforme*	3	3	2	2	1	1	1	1	-	-	-	-
10	*Fusarium redolens*	3	2	3	2	1	2	-	-	-	1	-	-
11	*Helminthosporium* sp.	2	2	-	-	-	-	-	-	-	-	-	-
12	*Mucor globosus*	2	2	-	-	-	-	-	-	-	-	-	—
13	*Penicillium funiculosum*	1	2	1	1	-	-	-	-	-	-	-	-
14	*Rhizopus stolonifer*	4	2	2	-	-	-	-	-	-	-	-	-
15	Sterile white mycelium	1	-	-	-	-	-	-	-	-	-	-	-
16	*Trichoderma viride*	4	2	2	1	1	1	-	-	-	-	-	-

tenuis (R), *Aspergillus carbonarius* (R and S), *Aspergillus fumigatus* (R and S), *Aspergillus nidulans* (R and S), *A. niger* (R and S), *Aspergillus sclerotiorum* (R and S), *Fusarium moniliforme* (R and S), *Fusarium redolens* (R and S), *Penicillium funiculosum* (R and S), *Rhizopus stolonifer* (R) and *T. viride* (R and S). More or less unaffected species were: *Aspergillus carbonarius, Aspergillus fumigatus*, *Aspergillus nidulans* and *T. viride.*

Table 2: Number of fungal colonies (10^3 /gm dry soil) tolerated to different concentration of Zineb in rhizosphere and soil at 30 day growth period.

	Zineb (µg/ml)					
	0	10	20	50	100	150
R	40.0	30.0	22.5	12.5	7.5	2.5
S	35.0	25.0	20.0	12.5	5.0	2.5
R/S	1.14	1.2	1.12	1	1.5	1

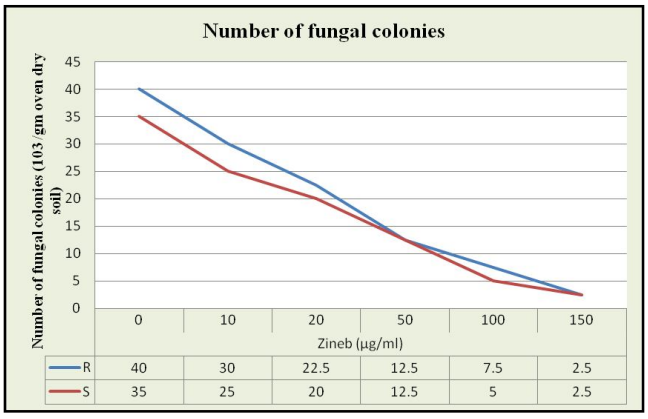

Fig. 1: Relationship between concentrations at Zineb (µg/ml) in the poisoned plates and fungal population from the rhizosphere and soil of *Capsicum annuum* L.

Quantitative results:

At 150 µg/ml concentration only 2.5 and 2.5 thousand population of survived as against 40.0 and 35.0 at '0' µg/ml Zineb in the rhizosphere and soil respectively. Tolerance limit of fungal population was 150 µg/ml in both rhizosphere and soil table 2.

Conclusion

Present investigation the lowest fungal population was registered at 30 day growth periods and more tolerable fungal species at 150 µg/ml zineb were *Aspergillus flavus, Aspergillus fumigatus, Aspergillus niger*, *Aspergillus carbonarius*, *Aspergillus sclerotiorum*, *Aspergillus flavipes, Aspergillus nidulans* and *Pencillium funiculosum.* At 150 µg/ml zineb were recorded *Aspergillus fumigates* statistically highly significant difference in fungal population was observed in rhizosphere and soil. There was decreased in the fungal population, both in rhizosphere and soil. As the fungicidal concentration increases in the plates, the fungal population decreases.

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