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In vitro studies on dry root rot in chickpea by using fungicides, natural farming products and organic amendments

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Abstract

Dry root rot caused by *Rhizoctonia bataticola* (Taub.) Butler is emerging as a serious biotic constraint for chickpea production. It is the most important and widespread soil borne disease of chickpea. Among the several constraints affecting the productivity of chickpea, 10-35 percent loss in yields are due to dry root rot diseases. Among them, dry root rot caused by *Rhizoctonia bataticola* is becoming severe in most of the chickpea growing regions of Andhra Pradesh. So to find out the best management strategies for the disease through bio-control agents, fungicides, natural farming products and organic amendments, investigation was carried during rabi 2017-18 in the study area.

Keywords: Chickpea, *Rhizoctonia bataticola*, fungicides, natural farming products, organic amendments, *in vitro* studies

Introduction

Chickpea (*Cicer arietinum* L.) is one of the major grain legume pulse crops grown in India and other semi-arid regions of the world. In India, chickpea is cultivated in an area of about 10.22 M ha with a production of 9.8 M t and with the average productivity of 920 kg ha⁻¹ (Ministry of Agriculture and Farmers Welfare, 2016-17). In Andhra Pradesh, it is grown in an area of 6.30 lakh ha with an annual production of 9.12 lakh t and with a productivity of 1233 kg ha⁻¹ (Ministry of Agriculture and Farmers Welfare, 2016).

The chickpea crop was reported to be attacked by nearly 172 pathogens (67 fungi, 22 viruses, 3 bacteria, 80 nematodes and mycoplasma) from all over the world (Nene *et al.*, 1996)^[9]. However, only a few have the potential in devastating the crop. Some of the serious diseases in chickpea are Dry root rot (*Rhizoctonia bataticola*), Wilt (*Fusarium oxysporum* f. sp. *ciceri*), Wet root rot (*Rhizoctonia solani*), Ascochyta blight (*Ascochyta rabiei*) and Collar rot (*Sclerotium rolfsii*). Of them, dry root rot caused by *Rhizoctonia bataticola* (Taub.) Butler, is a major hindrance for getting proper yields. The pathogen is soil borne, it infects the crop from seedling to maturity stages of the crop. Keeping this in view, an attempt was made to find out the suitable agents for the management against causal agent of dry root rot under *in vitro* conditions.

Material and Methods

The investigation was carried out in the laboratory of the Department of Plant Pathology, Agricultural College, Bapatla. The efficacy of different components were studied on the test fungus using Poison Food Technique. PDA plates with non poisoned medium inoculated with *R. bataticola* served as control. Radial growth of the *R. bataticola* was recorded in treatments and control as well as till the growth in control reached 9.0 cm. Percent inhibition of growth over control was calculated using the formula given by (Nene and Thapliyal, 1982)^[7].

$$\text{Percent inhibition} = \frac{C - T}{C} \times 100$$

I = percent inhibition
 C = growth in control
 T = growth in treatment

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The components used for studying their efficacy in inhibiting the growth of *R. bataticola* were detailed below;

Fungicides					
S. No	Common Name	Trade Name	Active Ingredient	Concentration studied (ppm)	Source of Supply
1	Captan	Captaf	50% WP	2000,2500,3000	Rallis India Ltd., Mumbai
2	Carbendazim	Zoom	50% WP	500, 1000, 1500	United Phosphorus Ltd., Gujarat
3	Hexaconazole	Contaf	5% EC	1500,2000,2500	Rallis India Ltd., Mumbai
4	Validamycin	Valliant	3% L	500,1000,1500	Mahindra and Mahindra Ltd., Mumbai
5	Pyraclostrobin	Headline	20% EC	1500,2000,2500	BASF corporation, USA
6	Azoxystrobin	Amistar	23% SC	500,1000,1500	Syngenta India Ltd., Pune, Maharashtra
7	Tebuconazole	Folicur	25.9 %EC	500,1000,1500	Bayer Crop Science Ltd., Mumbai
8	Copper oxychloride	Blitox	50% WP	2500,3000,3500	Rallis India Ltd., Mumbai
9	Propiconazole	Tilt	25% EC	500,1000,1500	Syngenta India Ltd., Pune, Maharashtra
10	Mancozeb	Indofil M-45	75 % WP	2500,3000,3500	Indofil Industries Ltd., Mumbai
Natural Farming Products			Concentration studied		Preparation details given below
1	Panchagavya		10%, 20%		
2	Bheejamrutham		10%, 20%		
3	Bheejaraksha		10%, 20%		
Organic Amendments					
1	Neem cake		10%, 15%, 20%		Sri Gopala Krishna Oil Mills, Tamil Nadu, India.
2	Castor cake		10%, 15%, 20%		Sri Gopala Krishna Oil Mills, Tamil Nadu, India.
3	Cotton cake		10%, 15%, 20%		Sri Raghavendra Oil Mills, Chebrolu, Guntur.

Preparation of Panchagavya

- Cow Milk – 2litres
- Cow Curd – 2 Litres
- Cow Urine – 3 Litres
- Cow Ghee – 500 grams
- Fresh cow dung – 5 kg
- Sugarcane juice – 3 kg
- Tender Coconut water – 3 litres
- Banana ripe – 12 numbers
- Toddy or grape juice – 2 litres

Panchagavya was prepared in a wide mouth container made of mud, concrete or plastic. The container should not be made of any metal. The first step is to mix fresh cow dung and ghee in the container. Mix it twice a day for three days. On the fourth day, add the remaining ingredients to the container. Stir the mixture twice a day for the next 15 days. On the 19th day, the Panchagavya mixture will be ready for use.

Preparation of Bheejamrutham

Materials Required

- Cow Urine – 5 Litres
- Cow Dung – 5 Kgs
- Calcium (Sunnam) – 50gms
- Water – 20 Litres
- Container with 40-50 litres capacity.

Take twenty litres water in container and add urine / calcium in water. Tie the cow dung in a cloth and hang it half way into the container. Mix everything very well and let it sit over night (24 hrs). Make sure to stir the mixture clockwise every 8 hours and squeeze the dung each time you stir. In 24 hours solution is ready to use.

Preparation of Bheejaraksha

Materials required

- Red sand – 100grams
- Cow dung cake powder – 100 grams
- Asofoetida (Inguva) – 20 grams
- Turmeric – 20 Grams
- Cow urine – 10 ml

Mix red sand and cow dung cake powder and make them into fine powder. Then add 20 g of Asofoetida and turmeric and

mix it well by adding cow urine slowly by drop wise. Then shade dry. Now the bheejaraksha is ready.

Preparation of aqueous extracts of natural farming products/ organic amendments/ fungicides

Desired concentrations (10% and 20%) of the natural farming product were prepared by adding 10g / 10ml of the product in 100ml water and mixed with the equal quantity of double strength PDA, sterilized and poured aseptically in sterilized Petri plates. The aqueous extracts of different organic materials viz., neem cake, cotton cake, mustard cake were prepared by suspending 30grams of each organic material in 150ml sterilized distilled water in flask and left for 10days. The flasks were shaken on alternate day for thorough mixing and dissolution of the content. After 10 days, the flasks were thoroughly shaken and content was filtered through double layered muslin cloth and autoclaved at 1.2kg cm⁻² pressure for 20minutes. The autoclaved extracts were individually added in previously sterilized molten PDA medium in desired concentration.

Ten ml stock solution of 1,00,000 ppm concentration was prepared in sterilized distilled water. To obtain the desired concentration of fungicide in the medium, amount of stock solution to be added was calculated by using the following formula.

$$C_1V_1 = C_2V_2$$

Where, C_1 = concentration of the stock solution (ppm)
 V_1 = volume of the stock solution to be added (ml)
 C_2 = desired concentration (ppm)
 V_2 = volume of PDA in which fungicide is to be amended (ml)

Required volume of the component was mixed with appropriate quantity of PDA in molten but cooled form. There after 20 ml of the poisoned medium was poured in to sterilized Petri plate (9.0 cm diameter) under aseptic conditions in Laminar air flow inoculation chamber and allowed to solidify. Each plate was inoculated in the centre with five mm diameter disc cut from the periphery of actively growing seven day old *R. bataticola* culture under aseptic conditions and incubated at 28±1°C in a BOD incubator. Three replications were maintained for each treatment.

Results and Discussion

Among the three natural farming products, beejamrutham is found to be highly effective and inhibited the growth of the mycelium at both 100 and 200 ppm concentrations. Beejarkasha did not show any effect and Panchagavya at 200ppm concentration recorded 25.50 percent inhibition on the mycelium growth of the test fungus (Table 1 and Plate 1). Castor cake and neem cake did not show any effect on the growth of the *R. bataticola* and at par with control. Cotton cake at 200 ppm inhibited growth of the mycelium to an extent of 88.22 percent followed by 150ppm concentration (63.66%) and were significantly different from each other (Table 2 and Plate 2).

The efficacy of natural products and organic amendments on the growth of the mycelium is follows;
 Control=panchagavya=beejarksha=neem cake= castor cake<cotton cake<beejamrutham
 Ashlesha and Paul (2004) [2] found that cow urine was most inhibitory to all the soil pathogens alone under *in vitro* conditions and in combination with other organic inputs under *in vivo*. Devakumar *et al.* (2014) [13] revealed that, Beejamrutha would give best result if it is used on the day of preparation. Dhingani *et al.* (2013) [4] found that neem cake was found to be high effective in reducing the growth of *M. phaseolina* causing dry root rot disease of chickpea followed by farm yard manure and whereas mustard and castor cake were poorer in reducing the growth of *M. phaseolina*.

Table 1: Effect of natural farming products on the growth of *R. bataticola*

Product	Growth of mycelium (cm)		% inhibition over control	
	100ppm	200ppm	100ppm	200ppm
Panchagavya	9.00 (3.08)	6.70 (2.68)	0.00	25.50
Bheejamrutham	0.00 (0.71)	0.00 (0.71)	100.00	100.00
Bheejaraksha	9.00 (3.08)	9.00 (3.08)	0.00	0.00
C.D(P≤0.05)	0.008			
C.V%	0.24			

*Figures in the parenthesis are square root transformed values

Table 2: Effect of organic amendments on the growth of *R. bataticola*

Product	Growth of mycelium (cm)			% inhibition over control		
	100ppm	150ppm	200ppm	100ppm	150ppm	200ppm
Cotton cake	7.73 (2.87)	3.27 (1.94)	1.06 (1.25)	14.22	63.66	88.22
Castor cake	9.00 (3.08)	9.00 (3.08)	9.00 (3.08)	0.00	0.00	0.00
Neem cake	9.00 (3.08)	9.00 (3.08)	9.00 (3.08)	0.00	0.00	0.00
C.D(P≤0.05)	0.15					
C.V%	1.19					

*Figures in the parenthesis are square root transformed values.

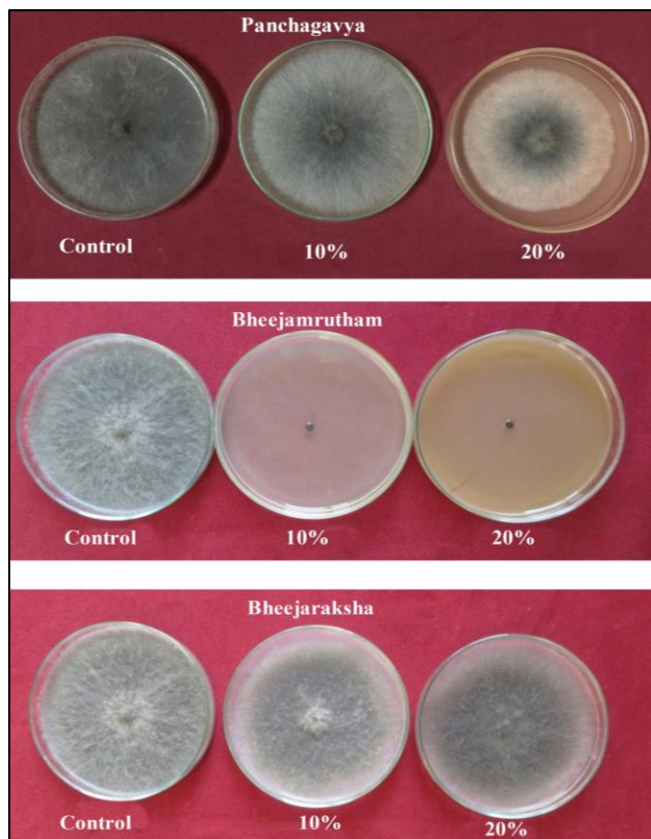


Plate 1: *In vitro* efficacy of natural farming products on the mycelial growth of *R. bataticola* by poisoned food technique.

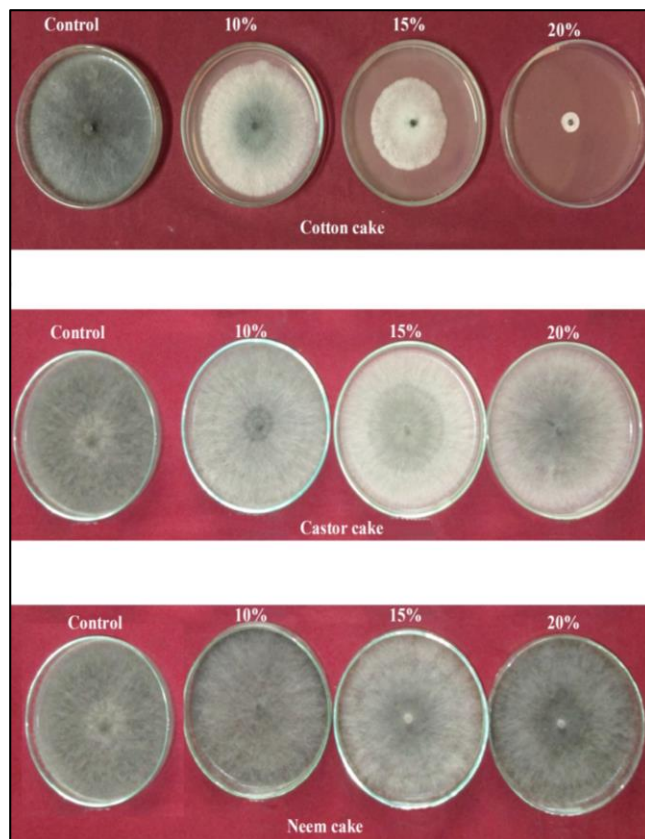


Plate 2: *In vitro* efficacy of organic amendments on the mycelial growth of *R. bataticola* by poisoned food technique

The data on efficacy of fungicides on mycelial growth of *R. bataticola* was presented in the Table 3 and in Plate 3 and Plate 4. The efficacy of ten fungicides on the growth of *R. bataticola* revealed that at all the concentrations carbendazim, pyraclostrobin, captan, hexaconazole, tebuconazole, mancozeb and propiconazole were found to be highly effective in completely inhibiting the growth of the fungus (100%).

Validamycin did not show any effect on the growth of the test fungus and at par with the control where as azoxystrobin inhibited the growth of *R. bataticola* to an extent of 31.88 percent at 1500 ppm concentration, 30.55 and 27.33 percent inhibition at 1000 and 500 ppm concentrations respectively and they were significantly different from each other. Copper oxychloride also found to be effective in inhibiting the growth of the fungus to an extent of 87.44 percent at 3500 ppm concentration.

Khan and Gangopadhyay (2008) [1] tested the efficacy of fungicides like carbendazim, carboxin, captan, chlorothalonil on mycelial growth of *M. phaseolina* and reported that carbendazim and captan were highly inhibitory to the pathogen. Veena *et al.* (2014) [11] found that fungicides copper oxy chloride, captan, hexaconazole and tebuconazole were found to be highly effective in inhibiting mycelial growth of *R. bataticola*, the highly virulent pathogen at all concentrations tested. Ravichandran and Hedge (2017) [10] evaluated five contact fungicides and four systemic fungicides against *R. bataticola* causing dry root rot disease of chickpea, among the contact fungicides chlorothalonil and mancozeb at 0.2% were effective in completely inhibiting mycelia growth and among systemic fungicides, carbendazim, difenoconazole and tebuconazole were best with cent percent inhibition of mycelial growth at all the concentrations tested.

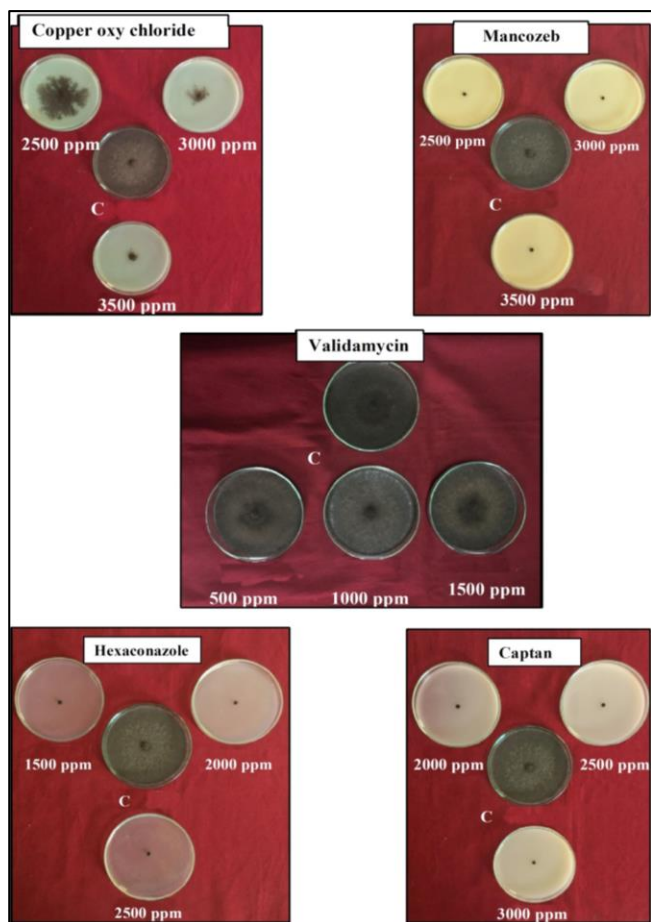


Plate 3: *In vitro* efficacy of different fungicides on mycelial growth of *R. bataticola* using poisoned food technique.

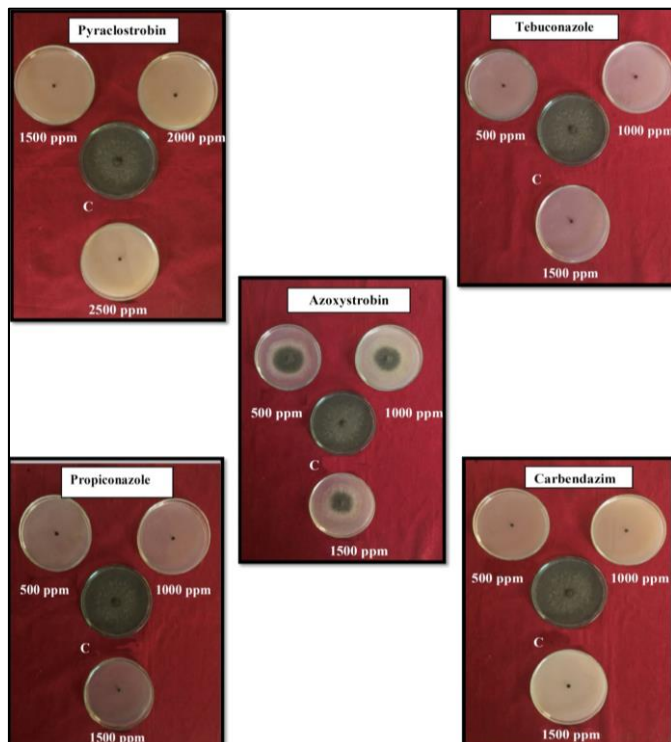


Plate 4: *In vitro* efficacy of different fungicides on mycelial growth of *R. bataticola* using poisoned food technique.

Table 3: *In vitro* efficacy of fungicides on the growth of *R. bataticola*

Fungicide	Concentration (ppm)	Mycelial growth (cm)	% inhibition over control
Carbendazim (50% WP)	500	0.00 (0.71) *	100.00
	1000	0.00 (0.71)	100.00
	1500	0.00 (0.71)	100.00
Pyraclostrobin (20% EC)	1500	0.00 (0.71)	100.00
	2000	0.00 (0.71)	100.00
	2500	0.00 (0.71)	100.00
Azoxystrobin (23% EC)	500	6.54 (2.55)	27.33
	1000	6.25 (2.57)	30.55
	1500	6.13 (2.59)	31.88
Captan (50% WP)	2000	0.00 (0.71)	100.00
	2500	0.00 (0.71)	100.00
	3000	0.00 (0.71)	100.00
Validamycin (3% L)	500	9.00 (3.08)	0.00
	1000	9.00 (3.08)	0.00
	1500	9.00 (3.08)	0.00
Hexaconazole (5% EC)	1500	0.00 (0.71)	100.00
	2000	0.00 (0.71)	100.00
	2500	0.00 (0.71)	100.00
Tebuconazole (25.9% EC)	500	0.00 (0.71)	100.00
	1000	0.00 (0.71)	100.00
	1500	0.00 (0.71)	100.00
Copper oxy chloride (50% WP)	2500	6.95 (2.77)	22.88
	3000	2.45 (1.73)	72.77
	3500	1.13 (1.30)	87.44
Mancozeb (75% WP)	2500	0.00 (0.71)	100.00
	3000	0.00 (0.71)	100.00
	3500	0.00 (0.71)	100.00
Propiconazole (25% EC)	500	0.00 (0.71)	100.00
	1000	0.00 (0.71)	100.00
	1500	0.00 (0.71)	100.00
Control	-	9.00 (3.08)	-
S.Em±	-	0.01	-
C.D.	-	0.04	-
C.V%	-	2.15	-

* Mean of four replications

* Figures in the parenthesis are square root transformed values.

References

1. Khan MA, Gangopadhyay S. Efficacy of *Pseudomonas fluorescens* in controlling root rot of chickpea caused by *Macrophomina phaseolina*. Journal of Mycology and Plant Pathology. 2008; 38(3):580-587.
2. Ashlesha, Paul YS. Antifungal bio efficacy of organic inputs against fungal pathogens of bell pepper. Indian Journal of Research. 2014; 3(6):4-9.
3. Deva Kumar N, Shubha S, Gouder SB, Rao GGE. Microbial analytical studies of traditional organic preparations beejaamrutha and jeevamrutha. Proceedings of 4th ISOFAR Scientific Conference. Istanbul, Turkey, 13-15 October 2014. Organic World Congress, 2014, 639-642.
4. Dhingani JC, Solanky KU, Kansara SS. Management of root rot disease [*Macrophomina phaseolina* (Tassi) Goid] of chickpea through botanicals and oil cakes. The Bio Scan. 2013; 8(3):739-742.
5. Ministry of Agriculture and Farmers Welfare, Pulses of India – Retrospects and Prospects. Department of Agriculture, Co-operation and Farmers Welfare. Government of India, 2016.
6. Ministry of Agriculture and Farmers Welfare, Annual Report. Department of Agriculture, co- operation and Farmers Welfare. Directorate of Pulses Development. Vindhyachal Bhavan. Bhopal, MP, 2016-17.
7. Nene YL, Thapliyal PN. Fungicides in Plant Disease Control, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, 1982, 325.
8. Nene YL, Thapliyal PN. Poison food technique. Fungicides in Plant Disease Control (2nd Edition). Oxford and IBH publication. New Delhi, India, 1993, 413-415.
9. Nene YL, Shelia VK, Sharma SB. A World List of Chickpea and Pigeonpea Pathogens (5th Edition), International Crop Research Institute for Semi Arid Tropics, Patancheru, Andhra Pradesh, 1996.
10. Ravichandran S, Hedge YR. Management of dry root rot of chickpea caused by *Rhizoctonia bataticola* through fungicides. International Journal of Current Microbiology and Applied Sciences. 2017; 6(7):1594-1600.
11. Veena GA, Eswarareddy NP, Bhaskara Reddy BV, Prasanthi L. Pathogenicity tests and evaluation of efficacy of fungicides against *Rhizoctonia bataticola*, the casual agent of dry root rot of chickpea. International Journal of Applied Biology and Pharmaceutical Technology. 2014; 5(1):283-287.