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In-vitro Evaluation of Fungicides and Botanicals against *Uromyces ciceris arietini* Inciting Chickpea Rust Disease

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Chickpea, commonly known as gram is one of the important pulse crops in India. The crop faces numerous disease attacks, resulting in losses to both quality and quantity. Among the diseases, rust caused by *Uromyces ciceris arietinum*, is a sporadic disease of chickpea. Considering the notoriority of disease A study was conducted at department of plant Pathology and Agril Microbiology, PGI MPKV, Rahuri during 2021-22 which aimed to assess the efficacy of fungicides against the pathogen causing rust disease under in vitro conditions. Among five fungicides, Tebuconazole 50% + Trifloxystrobin 25% w/w WG and Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC were found cent per cent effective against *U. ciceris arietini,* which completely inhibited uredospore germination at all three concentrations, *viz*. 50 ppm, 100 ppm, 500 ppm. However, Propiconazole 25% EC, Tebuconazole 25% EC and Hexaconazole 5% SC were found cent per cent effective against test pathogen only at 500 ppm. Among botanicals, *Azadirachtin* and Pongamia oil showed effective treatments to some extent. Maximum uredospore germination (63%) was recorded in control (Tap water).

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Keywords: Uromyces ciceris arietinum; fungicides; botanicals; chickpea.

1. INTRODUCTION

In India chickpea is grown predominantly in Rabi season. Maharashtra state ranked first in the area with 22.31 lakh ha under chickpea cultivation. Total production of 23.96 lakh tonnes with productivity of 1192 kg/ ha was recorded [1]. The emerging disease chickpea rust caused by *Uromyces Ciceris arietini* became severe in western Maharashtra in recent past. Symptoms under field conditions were small round or oval, light brown to dark brown pustules on leaves, which later tend to combine and produce larger pustules and observed on both sides of the leaves [2]. Inadequate management practices employed against chickpea rust disease includes early sowing, spraying 0.2% mancozeb 75% WP, two times at 10 days intervals starting from appearance of disease to escape the disease [3]. So, it was necessitated to identify effective fungicide to combat the devastating disease, consequently the study begun with *in-vitro* studies. Five fungicides and two botanicals were tested under *in-vitro* conditions using cavity slide method and observations on spore germination and germ tube elongation were recorded after 24 hrs.

2. MATERIALS AND METHODS

Uredia of the test pathogen were collected from infected samples on experimental farm PGI MPKV Rahuri and identified as *Uromyces ciceris arietini* on the basis of morphology, as described by Punithalingam [4]. The culture was maintained in glasshouse on seedlings of variety 'Phule vikram'. The required concentrations of fungicides were prepared by dissolving known quantity of fungicides in known quantity of sterile distilled water separately under aseptic conditions. Twenty five microliter of each fungicide solution was pipetted out on cavity slides and uredospores were added by scraping one uredium of infected chickpea leaf with a sterilized scalpel. Three replications were maintained for each treatment. Effect of fungicides and their concentrations on the germination of uredospores were observed after 24 hrs of incubation in a moist chamber [5]. A control was maintained with distilled water. Per cent inhibition over the control was calculated by using the formula given by Vincent [6]. Later data was analysed using completely randomised design.

$$I = (C - T) / C \times 100$$

I = Per cent inhibition
C = Germination of uredospores in control.
T = Germination of uredospores in treatment

3. RESULTS AND DISCUSSION

Five fungicides and two botanicals were evaluated against uredospore germination inhibition of *U. ciceris arietini* using cavity slide method. Also, observations were interpreted on percent uredospore germination inhibition and inhibition of germ tube elongation after 24 hours of incubation at 20^0C.

Data presented in Table 1, showed that, among five fungicides tested, treatment T_4 i.e., Tebuconazole 50% + Trifloxystrobin 25% w/w WG and treatment T_5 i.e., Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC were found cent per cent effective against *U. ciceris arietini,* which completely inhibited uredospore germination at all three concentrations, *viz*. 50 ppm, 100 ppm, 500 ppm. However, Propiconazole 25% EC (T_1), Tebuconazole 25%EC (T_2) and Hexaconazole 5% SC (T_3) were found cent per cent effective against test pathogen only at 500 ppm. Among botanicals, *Azadirachtin* (T6) and Pongamia oil (T_7) showed effective treatments to some extent with 33.6, 23.33, 23.00 and 62.33, 43.66, 37.66 per cent germination at 50 ppm, 100 ppm, and 500 ppm respectively. Pongamia oil (T_7) was not effective and it was at par with control (Tap water) at 50 ppm. Maximum uredospore germination (63%) was recorded in control (Tap water).

These results are agreed with previous findings of Bambalwad et al., [7]. They observed maximum per cent inhibition of uredospore germination of *U. phaseoli var. vignae* in 50 ppm propiconazole 25% EC (78.87%), followed by hexaconazole 5% EC (77.37%). Whereas, they found least per cent inhibition of uredospores germination in treatment with tebuconazole 25% EC at 10 ppm (67.17%) followed by difenoconazole 25% EC (75.70%). Similarly, Sharma et al. [8] tested *in-vitro* efficacy of fungicides against uredospore germination of *Puccinia graminis tritici* and observed that Azoxystrobin + tebuconazole and tebuconazole + Trifloxystrobin were best fungicides with mean uredospore germination inhibition of 96.38 and 95.09% followed by propiconazole and hexaconazole by recording mean germination inhibition of 94.83 and 92.76%.

Table 1. Uredospore germination after 24 hrs at different concentrations of fungicides and botanicals

Sr. No.	Fungicides	% germination of uredospores at different concentrations after 24 hrs					
		50 ppm		100 ppm		500 ppm	
		% Germination	% Inhibition	% Germination	% Inhibition	% Germination	% Inhibition
T_1	Propiconazole 25% EC	21.66 (27.73)	65.60 (54.07)	6.66 (14.89)	89.41 (71.06)	0.00 (0.00)	100 (90.00)
T_2	Tebuconazole 25%EC	19.33 (26.07)	69.30 (56.34)	4.33 (11.89)	92.11 (73.71)	0.00 (0.00)	100 (90.00)
T_3	Hexaconazole 5% SC	24.66 (29.76)	64.01 (53.12)	9.33 (17.78)	85.18 (67.33)	0.00 (0.00)	100 (90.00)
T_4	Tebuconazole 50% + Trifloxystrobin 25% w/w WG	0.00 (0.00)	100 (90.00)	0.00 (0.00)	100 (90.00)	0.00 (0.00)	100 (90.00)
T_5	Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC	0.00 (0.00)	100 (90.00)	0.00 (0.00)	100 (90.00)	0.00 (0.00)	100 (90.00)
T_6	Azadirachtin	33.6 (35.39)	46.55 (42.99)	23.33 (28.87)	62.96 (52.49)	23.00 (28.64)	63.48 (52.81)
T_7	Pongamia oil	57.00 (49.00)	9.52 (17.58)	43.66 (41.36)	30.68 (33.61)	37.66 (37.85)	40.20 (39.33)
T_8	Tap water	63.00 (52.51)	0.00 (0.00)	63.00 (52.51)	0.00 (0.00)	63.00 (52.51)	0.00 (0.00)
SE		0.97	1.59	0.68	0.73	0.41	0.48
CD at 1%		2.94	4.81	2.07	2.22	1.24	1.45

(Figure in parenthesis are angular transformed values)

Among botanicals, the neem extract at 7.5% showed highest inhibition of 68.06%. similarly, Patil and Kamble [9] evaluated aqueous leaf extracts against uredospore germination of *U. ciceris arietini* by using propiconazole (0.05%) as a standard check and distilled water as a control and found that *Argemone mexicana* L. and *Eupatorium odoratum* L. shows higher inhibition of the uredospore germination. While, Kambale and Patil [10] tested aqueous plant extracts of 12 plants and one 'panchparni extract' under *in-vitro* conditions against uredospore germination of *U. appendiculatus* along with propiconazole (0.1%) as standard check, distilled water as control and found that 7% concentration of plant extracts with 6 hour incubation period was effective.

4. CONCLUSION

Combination fungicides, Tebuconazole 50% + Trifloxystrobin 25% w/w WG and Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC were cent per cent effective against *U. ciceris arietini,* at all three concentrations, *viz*. 50 ppm, 100 ppm, 500 ppm.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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