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Evaluation of Some New Generation Fungicides against Pigeonpea (*Cajanus cajan* (L.) Millsp.) Wilt Causal agent *Fusarium udum* under *in vitro* Conditions

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Pigeonpea wilt disease caused by *Fusarium udum* is one of the most devastating soil borne disease. The objective of this investigation was to determine the antifungal activities of fungicides which can be used to control wilt disease of pigeonpea. Among all the fungicides Azoxystrobin+Tebuconazole, Carbendazim, Tebuconazole+Trifloxystrobin, Hexaconazole, Tebuconazole exhibited 100% inhibition at all the concentrations, followed by Azoxystrobin+ Difenconazole which exhibited 92.22%, 94.4%, 94.4% and 100% inhibition at 250 ppm, 500 ppm, 750 ppm and 1000 ppm respectively.

Keywords: Pigeonpea; Fusarium udum; fungicides.

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1. INTRODUCTION

Pigeonpea (*Cajanus cajan* (L.) Millsp.) is one of the most important pulse crop in India belonging to the family Fabaceae. Globally, pigeonpea is cultivated on 6.99 M ha with production of 5.93Mt and with productivity of 852 kg/ha. In India, it is cultivated on 45 Lha, with annual production of 42 Lt and contributing nearly 90% of world's acreage and production [1]. The productivity of pigeonpea was affected by both biotic and abiotic factors; amongst the biotic factors the most important being the diseases. Some of the important diseases are *Fusarium* wilt, *Phytopthora* blight, *Cercospora* leaf spot, collar rot, dry root rot, *Alternaria* leaf spot, powdery mildew, sterility mosaic and phyllody. Among all the diseases incidentally, only a few of them cause economic losses in India [2]. Among the diseases, *Fusarium* wilt caused by *Fusarium udum* is the most important soil borne disease and was first reported from Bihar state in India [3]. The disease is a serious problem all over the pigeonpea growing states especially in U.P., M.P., Bihar and Maharashtra [4]. The fungus is primarily a soil borne facultative parasite and enters the host through fine roots and subsequently colonizes different plant parts. The yield loss of pigeonpea depends on the stage at which the plants wilt and it can approach 100, 67 and 30 per cent when wilt occurs at pre-pod, maturity and pre-harvest stages, respectively [5] and sometimes it causes losses up to 100% in grain yield [6]. Hence, for minimizing the losses, there is a need to identify best effective and inexpensive methods for the management of the disease and there is no doubt that till date, rational chemical control is the best method for the management of plant diseases. Considering the point in view, the present investigation was carried out to evaluate fungicides for pigeonpea wilt management.

2. MATERIALS AND METHODS

2.1 Collection of Wilt Infected Pigeonpea Plants

Pigeonpea plants exhibiting typical symptoms of *Fusarium* wilt were collected from AICRP Pigeonpea wilt sick plot at Dholi. Tissue segment technique was used for pathogen isolation from the diseased samples. Diseased plants collar portion were split longitudinally with sterile knife and brown discoloured vascular tissues of plants were cut into small bits. Surface sterilization was done by dropping diseased plant pits in sodium hypochlorite solution (1%) for one minute, cleaned with 3 changes of sterile distilled water, dried on blotting paper and then moved aseptically on to potato dextrose agar (PDA) medium at 4 bits/Petri plate and incubated in an incubator at 25 $\pm$ 2°C. Single spore isolation technique was used for obtaining pure and homogenous cultures. Spore suspensions of *Fusarium udum* were prepared in test tubes with sterile distilled water and the concentration was adjusted to 4-5 spores per field of microscope. In sterilized Petri plates, one ml of spore suspension was added, into which 2% water agar medium was poured. For getting uniform spread of spores in the medium, plates were rotated gently. Isolated single spores were located after twenty four hours and marked by observing the plates through microscope. Single spores were picked along with medium, transferred to PDA slants under aseptic conditions and incubated at 25±2°C in an incubator.

The nine fungicides: Azoxystrobin, Azoxystrobin+Tebuconazole, Azoxystrobin+Difenconazole, Carbendazim, Tebuconazole+Trifloxystrobin, Propiconazole, Hexaconazole, Difenconazole and Tebuconazole were tested at 250 ppm, 500 ppm, 750 ppm and 1000 ppm. The required amount of each fungicide on the basis of active ingredient (a.i) was calculated, thoroughly mixed with autoclave and cooled (40-45°C) on PDA in conical flasks to obtain desired concentration of 250, 500, 1000, 1500 ppm. 20 ml of PDA mediim was poured in sterilized Petri plates and allowed to be solidified. Fungal disks of 5 mm in diameter from 7 days old culture were placed in the centre of the Petri dish containing cultue medium under aseptic condition, incubated at 27±2 °C for 7 days. Three replicates of the plates were used for each concentration of every fungicide. Three replicates of PDA plates which received no fungicides served as control. The diameters of the colonies on PDA with and without fungicides were measured from the bottom side of the Petri dishes and recorded. The per cent fungicide inhibition was calculated by using the following formula:

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

Where,

I = Per cent inhibition over control
C = Radial growth of pathogen in control (mm)
T = Radial growth of pathogen in treatment (mm)

3. RESULTS AND DISCUSSION

Nine fungicides were evaluated at 250 ppm, 500 ppm, 750 ppm and 1000 ppm against the *Fusarium udum* under *in vitro* conditions. Among all the fungicides Azoxystrobin+Tebuconazole, Carbendazim, Tebuconazole+Trifloxystrobin, Hexaconazole, and Tebuconazole exhibited 100% inhibition at all the concentrations, followed by Azoxystrobin+Difenconazole which exhibited 92.22%, 94.4%, 94.4% and 100% inhibition at 250 ppm, 500 ppm, 750ppm and 1000 ppm respectively. Difenconazole exhibited 94.44% inhibition, Propiconazole exhibited 92.22% at all the concentrations and Azoxystrobin exhibited 69.25%, 86.66%, 90.00%, and 92.22% at 250 ppm, 500 ppm, 750 ppm and 1000 ppm respectively. Results revealed that all the tested fungicides significantly inhibited mycelial growth of *F. udum,* compared to untreated control.

Plate 1. Evaluation fungicides against *Fusarium udum*

Table 1. Antagonistic activity fungicides against *Fusarium udum*

S. no	Treatments	250 ppm	500 ppm	750 ppm	1000 ppm
1	Azoxystrobin	69.25	86.66	90.00	92.22
2	Azoxystrobin+Tebuconazole	100	100	100	100
3	Azoxystrobin+Difenconazole	92.22	94.4	94.4	100
4	Carbendazim	100	100	100	100
5	Tebuconazole+Trifloxystrobin	100	100	100	100
6	Propiconazole	92.22	92.22	92.22	92.22
7	Hexaconazole	100	100	100	100
8	Difenconazole	94.55	94.44	94.44	94.44
9	Tebuconazole	100	100	100	100
10	Control	0	0		0
	Factors	C.D.		SE(M)	
	Factor(A)	0.52		0.18	
	Factor(B)	0.33		0.11	
	Factor(AXB)	1.05		0.37	

The above results are in accordance in with the findings of several researchers. Patiyal et al. [7] screened various fungicides at 50%, 100% and 150% and reported that average per cent inhibition of Azoxystrobin+Tebuconazole were (63.61), Difenconazole (49.16), Azoxystrobin (45.13) and Azoxystrobin+Difenconazole (40.83). Ghante et al. [8] evaluated various fungicides against *Fusarium udum* and reported that azoxystrobin, hexaconazole, difenconazole are effective under *in vitro* conditions. Similar type of results were revealed by Gadhave et al. [9] who screened various fungicides and concluded that carbendazim were effective against *Fusarium lycopersici* under *in vitro* conditions. Kumar et al. [10] reported that propiconazole were effective in inhibiting the mycelial growth of *Fusarium udum* under *in vitro* conditions. Rao et al. [11] evaluated various fungicides against the *Fusarium* under *in vitro* conditions. Results revealed that propiconazole 13.9% + difenoconazole 13% gave the best results by showing of 100% inhibition at 0.1% concentrations.

4. CONCLUSION

The study revealed that under *in vitro* conditions revealed that Azoxystrobin+Tebuconazole, Carbendazim, Tebuconazole+Trifloxystrobin, Hexaconazole, Tebuconazole exhibited 100% inhibition at all the concentrations against *Fusarium udum*. Further studies were needed to know the efficacy fungicides at field conditions.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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