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MANAGEMENT OF WILT DISEASE OF PIGEONPEA (*CAJANUS CAJAN* L. MILLSP.) CAUSED BY *FUSARIUM UDUM* THROUGH FUNGICIDES

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ABSTRACT

Pigeonpea [*Cajanus cajan* (L.) Millsp.] is a major grain legume crop, which belongs to the Leguminoseae family. The word 'Cajanus' comes from Malay word 'Katschang' or 'Katjang' which means pod or bean. Pigeonpea is the second most important pulse crop of India, after chickpea. India ranks first in its production and contributes to 90 per cent of global pigeonpea (Mesapogu *et al*., 2012). Among biotic stresses only a few diseases cause economic losses. The diseases of considerable economic importance are Fusarium wilt, sterility mosaic virus, Phytophthora blight, Cercospora leaf spot, collar rot, dry root rot, Alternaria leaf spot, powdery mildew and phyllody caused by Phytoplasma. Crop yield losses vary based on the stage of infection. It causes upto 100 per cent losses in grain yield under extreme conditions (Pande *et al.,* 2011). In Wilt disease the xylem develops black streaks, leading to brown or dark purple bands on the stem surface of partially wilted plants, visible when the stem or primary branches are split open. Among the fungicides, Propiconazole 25 EC % and Tebuconazole 50 % + Trifloxystrobin 25 % 75 WG were superior in inhibiting the growth at all three concentrations with cent per cent inhibition.

Keywords: Disease, Yield, Brinjal, Crop.

Introduction

Pigeonpea [*Cajanus cajan* (L.) Millsp.] is a major grain legume crop, which belongs to the Leguminoseae family. The word 'Cajanus' comes from Malay word 'Katschang' or 'Katjang' which means pod or bean. Pigeonpea is the second most important pulse crop of India, after chickpea. India ranks first in its production and contributes to 90 per cent of global pigeonpea (Mesapogu *et al*., 2012).

In India, it is grown in an area of 4.74 million hectares with the production of 4.22 million tonnes and productivity of 880 kg/ha (Anonymous, 2020). In Rajasthan, pigeonpea occupies an area of 6020 hectares with a production of 5680 tonnes and productivity of 899 kg/ha (Anonymous, 2022).

India is the leading producer of pigeon pea; however, the average yield of this crop falls short of its potential due to biotic and abiotic stresses as well as insufficient management practices. Among biotic stresses only a few diseases cause economic losses. The diseases of considerable economic importance are Fusarium wilt, sterility mosaic virus, Phytophthora blight, Cercospora leaf spot, collar rot, dry root rot, Alternaria leaf spot, powdery mildew and phyllody caused by Phytoplasma.

Fusarium wilt in pigeonpea, caused by the pathogen *Fusarium udum*, is widespread and has become a significant biotic threat to pigeonpea cultivation across all growing regions (Choudhary *et al*., 2023).

Crop yield losses vary based on the stage of infection. It causes upto 100 per cent losses in grain yield under extreme conditions (Pande *et al.,* 2011). Infected plants can exhibit partial wilting despite having adequate soil moisture, distinguishing the disease from termite damage, drought and Phytophthora blight, which typically kill the entire plant. Partial wilting is associated with lateral root infection, while total wilting is linked to tap root infection. An early internal symptom is a purple band extending upward from the base of the main stem. The xylem develops black streaks, leading to brown or dark purple bands on the stem surface of partially wilted plants, visible when the stem or primary branches are split open. The severity of browning or blackening decreases from the base toward the tip. Sometimes, lower branches dry out and exhibit die-back symptoms with a purple band extending downward and severe internal xylem blackening. Young plants (1-2 months old) that succumb to wilt may not show the purple band but display noticeable internal browning and blackening (Karimi *et al*., 2012).

Looking to the regular occurrence of the disease in moderate to severe form in Uttar Pradesh region, seriousness of the disease and economic importance of the crop, it is necessary to manage the disease Pathogen using different Fungicides against the disease Pathogen under *in vitro* condition.

Materials and Methods

The present investigation entitled "Studies on Wilt Disease of Pigeonpea [*Cajanus cajan* (L.) Millsp.] caused by *Fusarium udum*'' was undertaken during 2023-24. The experiments were conducted in the laboratory of Department of Plant Pathology, College of Agriculture, Ummedganj-Kota.

In-vitro evaluation of fungicides

Various fungicides as listed below at different concentrations were evaluated for their effectiveness against pathogen by poisoned food technique as suggested by Nene and Thapliyal (2015).

Experimental details

Design: CRD, Replication: 3, Treatment: 8

Table 1 : Details of fungicides and concentrations used

S.No.	Common name of fungicide	Concentration (ppm)
1.	Copper oxychloride 50% WP	100, 150 and 200
2.	Carbendazim 50% WP	100, 150 and 200
3.	Tebuconazole 25.9% EC	100, 150 and 200
4.	Hexaconazole 5% SC	100, 150 and 200
5.	Propiconazole 25 EC%	100, 150 and 200
6.	Tebuconazole 50% + Trifloxystrobin 25% 75WG	100, 150 and 200
7.	Thiophanate methyl 70% WP	100, 150 and 200
8.	Control	-

Above listed fungicides were tested *in vitro* against *Fusarium udum*. 100 ml potato dextrose agar medium was sterilized in conical flask of 250 ml capacity. Requisite quantities of fungicides were separately added aseptically in molten PDA to make 100, 150 and 200 ppm concentration. The amended medium was poured in sterilized Petri plates. Six mm disc of test fungus was cut with the help of sterilized cork borer from the margin of 3 days old culture and then placed centrally in Petri plates. The disc was placed in inverted position to allow the contact of fungus with medium. The inoculated Petri plates were incubated in the BOD incubator at 27 ± 1ºC and the colony diameter of the pathogen was measured after 4 and 8 days of incubation with the help of scale in milimeter. Per cent inhibition of mycelial growth over control under the influence of different fungicides was calculated by using the formula given by Vincent (1947). The data were analysed statistically.

The per cent inhibition of growth of the pathogen was calculated by using the formula suggested by Vincent (1947).

$$PGI = \frac{C - T}{C} \times 100$$

Where,

PGI = Per cent growth inhibition

C = mycelial growth in control (mm)

T = mycelial growth in treatment (mm)

Results

In vitro evaluation of fungicides against *Fusarium udum*

The efficacy of fungicides was studied *in vitro* at three different concentrations *viz.*, 100, 150 and 200 ppm against *Fusarium udum* (Isolate: RSBU1) on PDA medium by following standard procedure of poisoned food technique as mentioned in material and methods. Data suggested that increase in concentration of fungicides resulted in increased inhibition of mycelium growth of fungus (Table 2 and Plate 1).

Among the fungicides tested, propiconazole 25 EC% and tebuconazole 50% + trifloxystrobin 25% 75WG were found to be superior in inhibiting the growth of *Fusarium udum* at all three concentrations with cent per cent inhibition of mycelial growth followed by hexaconazole 5 % SC with 93.45 per cent inhibition. However, copper oxychloride 50% WP showed the least per cent inhibition of mycelial growth at all three concentrations with a mean per cent inhibition of 43.52 per cent.

Propiconazole 25 EC% and tebuconazole 50% + trifloxystrobin 25% 75 WG showed the maximum per cent mycelial growth inhibition (100%) at 100 ppm, followed by hexaconazole 5% SC (87.04 %), tebuconazole 25.9% EC (74.44 %). and least per cent inhibition was recorded for copper oxychloride 50% WP (22.15 %) at 100 ppm which was followed by carbendazim 50% WP (33.22%).

At concentration of 150 ppm, propiconazole 25% EC and tebuconazole 50% + trifloxystrobin 25% 75 WG showed cent per cent inhibition of mycelial growth of test fungus followed by hexaconazole 5 % SC (93.33 %), tebuconazole 25.9 % EC (82.22 %) and least per cent inhibition was exhibited by copper oxychloride 50% WP (61.16%).

At 200 ppm, hexaconazole 5% SC, propiconazole 25% EC and tebuconazole 50% + trifloxystrobin 25% 75WG showed complete inhibition of mycelial growth (100 %) of *Fusarium udum* followed by tebuconazole 25.9 % EC (84.39 %), thiophanate methyl 70% WP (87.39 %), carbendazim 50% WP (80.74 %). Least per cent inhibition was shown by copper oxychloride 50% WP (76.67%).

Table 2: *In vitro* evaluation of fungicides against *Fusarium udum,* causing wilt disease of pigeonpea

S. No.	Treatments	Per cent mycelial growth inhibition*			
		100 ppm	**150 ppm**	**200 ppm**	**Mean**
1.	Copper oxychloride 50% WP	22.15** (28.07)	31.76 (34.29)	76.67 (61.09)	43.52 (41.15)
2.	Carbendazim 50% WP	33.22 (35.18)	61.16 (51.42)	80.74 (63.96)	58.37 (50.19)
3.	Tebuconazole 25.9% EC	74.44 (59.61)	82.22 (65.04)	84.39 (66.75)	80.35 (66.75)
4.	Hexaconazole 5% SC	87.04 (68.88)	93.33 (75.04)	100.00 (90)	93.45 (76.05)
5.	Propiconazole 25 EC%	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)
6.	Tebuconazole 50% + Trifloxystrobin 25% 75 WG	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)
7.	Thiophanate methyl 70% WP	73.09 (58 .73)	85.63 (67.94)	87.39 (69.19)	82.13 (65.29)
8.	Control	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
		S Em ±	**CD at 0.05%**		
	Treatments	0.22	0.64		
	Concentrations	0.13	0.39		
	T X C	0.39	1.12		

*Average of three replications of each concentration;
**Figures in parentheses are Arc sine per cent angular transformed values

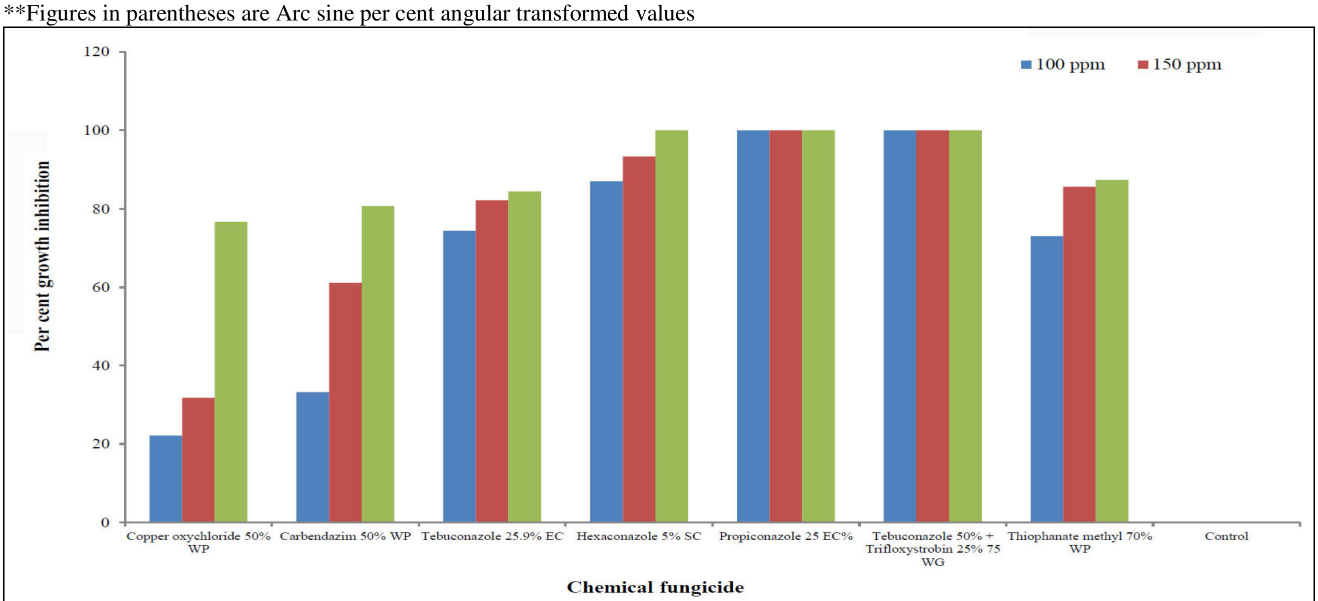

Fig. 1: *In vitro* evaluation of fungicides against *Fusarium udum,* causing wilt disease of pigeonpea

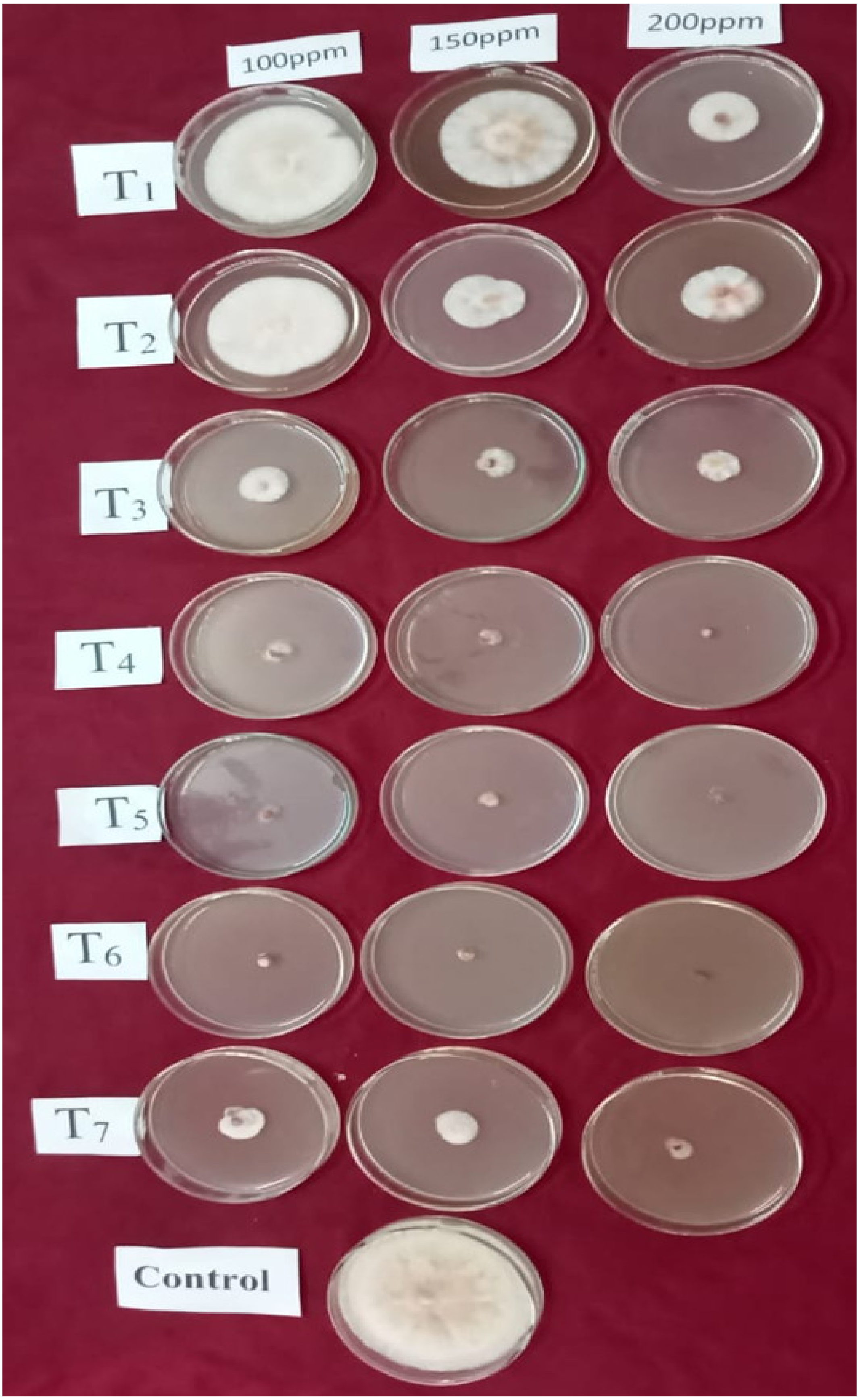

Plate 1: Evaluation of fungicides against *Fusarium udum,* causing wilt disease of pigeonpea

Discussion

In vitro evaluation of fungicides against the *Fusarium udum*

In the present investigation, the efficacy of different fungicides was studied *in vitro* at three different concentrations *viz.*, 100, 150 and 200 ppm against *Fusarium udum* (Isolate: RSBU1) on PDA medium by following standard procedure of poisoned food technique. Among the fungicides tested, propiconazole 25 EC% and tebuconazole 50% + trifloxystrobin 25% 75WG were found superior in inhibiting the growth of *Fusarium udum* at all three concentrations with cent per cent inhibition of mycelial growth followed by hexaconazole 5% EC (93.45%) and tebuconazole 25.9% EC (80.37%). However, copper oxychloride 50% WP showed least per cent inhibition of mycelial growth at all three concentrations with a mean per cent inhibition of 43.52 per cent.

The results obtained during present investigations are similar with Chennakesavulu *et al.,* 2013 and Naresh *et al*., 2016 who found that per cent inhibition of mycelial growth of *Fusarium udum* was maximum with propiconazole and tebuconazole. However, Hukmaram and Pandey, 2011, reported that carbendazim (500 µg ml^{-1}), difenconazole (100 µl ml^{-1}), hexaconazole (200 µl ml^{-1}) and combi products of captan + hexaconazole (250 µg ml^{-1}) showed complete inhibition of the mycelial growth of the pathogen. These results are also in agreement with Patel *et al.,* 2021, who observed that carbendazim (0.1%) and tebuconazole (0.1%) were found to be the best as solo fungicides which completely inhibited the radial growth of *Fusarium udum.*

Conclusion

Among the fungicides, Propiconazole 25 EC % and Tebuconazole 50 % + Trifloxystrobin 25 % 75 WG were superior in inhibiting the growth at all three concentrations with cent per cent inhibition.

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