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EVALUATION OF PIGEONPEA GENOTYPES FOR RESISTANCE TO FUSARIUM WILT

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Abstract

Fusarium wilt is a serious disease in pigeonpea, which causes severe yield losses. Screening of eight pigeonpea genotypes *viz*; ICP 8863, ICPL 84060, BSMR 853, AGT 2, GT 101, T 15-15, AVPP 1 and LRG 41 were subjected for pot and water culture screening using artificial inoculation. The wilt incidence was ranged between 0-90% in the wilt sick pot and between 0-100% in the water culture screening technique. The results indicated both the screening methods with inoculum concentration of 6.5 x 10^5 spores/ml were efficient in screening for wilt disease and the genotype ICP 8863 had shown resistance against *Fusarium udum* in both the screening techniques.

Key words : Pigeonpea, *Fusarium udum*, inoculum concentration.

Introduction

Pigeonpea [*Cajanus cajan* (L) Mills.] is major pulse crop grown component of pulses grown in India and belongs to family leguminosae. It possesses high protein content and is consumed in the form of split pulse as dal. In Gujarat, it is extensively cultivated in upland hilly regions as sole as well as intercrop with maize, sorghum, groundnut, soybean and cotton. In Gujarat, total area under pigeonpea cultivation is 2.65 lakh hectares with an annual production of 2.94 lakh tons and productivity of 1109 kg/ha (Anonymous, 2011). A single largest factor responsible for such a low productivity in pigeonpea is low plant population (Mahanta, 2000), which is due to several biotic and abiotic constraints. Among these, wilt disease caused by *Fusarium udum* is the most important problem in India causing heavy production losses. The *F. udum* is host specific to pigeonpea (Patel *et al*., 2011) and can survive in soil under wilted plant stubble for a long period. The best way of wilt management is by growing resistant varieties. For developing resistant varieties, resistant source are the basic requirements. Identification of resistant sources involves testing germplasm under heavy inoculum potential and under conditions conducive for maximum disease development. Sick plot technique has been reported for large scale screenings under field conditions and a sick soil technique (pot screening) for confirming resistance. The present experiment was conducted for rapid screening of pigeonpea genotypes in pot culture and in water culture in laboratory condition through artificial inoculation of *Fusarium udum* culture.

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Materials and Methods

Experimental material for artificial inoculum (pot culture and water culture) screening was comprised of three resistant (ICP 8863, ICPL 84060, BSMR 853) and five susceptible (AGT 2, GT 101, T 15-15, AVPP 1 and LRG 41) genotypes.

Isolation and purification of *F. udum* isolates

Pigeonpea plants showing typical vascular wilt symptoms were collected from Dahod, Gujarat. Wilt infected stem and roots were split open and parts showing brown discoloration of vascular tissues were cut into small bits, surface sterilized by dipping in 1% sodium hypochlorite for one minute, rinsed with three changes of sterile distilled water, blot dried and then transferred aseptically on to petri plates were incubated at 27 ± 2°C in an incubator. The radial growth, colony characters, sporulation and pigmentation were recorded after 9 days of incubation.

Pot culture screening of parental genotypes

The seeds of eight parental lines (table 1) were thoroughly surface sterilized with 2% hypochlorite followed by rinsing with distilled water thrice. Ten seeds of each parental genotype were sown in three pots containing sterilized soil alongwith control (no inoculation)

genotype T 15-15. The experiment was planned in completely randomized design during *kharif* 2013.

For preparation of primary inoculum, 5 mm fungal disc from the periphery of an actively growing colony of *F. udum* after five days of growth of isolate was transferred on to sorghum grain medium. To prepare sorghum grain medium sorghum grains were pre-soaked in 2 per cent sucrose solution for overnight and then 100 g sorghum grains autoclaved in 500 ml glass bottles. After cooling the bottles were incubated at 27±2° C for 10 days with fungus. The spore suspension was prepared by transferring sorghum grain medium with sporulating fungus into distilled water and filtered through doubled layered muslin cloth. The spore concentration was determined with haemocytometer. The filtrate was diluted with distilled water to obtain desired inoculum concentration of 6.5×10^5 spores/ml. A total of 100 ml of fungal suspension was poured/spread to soil of each pre-sown pot 10 days after seed germination. Disease incidence was observed on 25th day of inoculation and the number of wilted plants were counted and data were subjected for statistical analysis.

Water culture screening of parental genotypes

For water culture technique, spore suspension was prepared as same as pot culture technique. For inoculation, big sized test tubes (250 × 20 mm) were filled upto ¾ level with the spore suspension. Later on, ten days old seedlings of each parental genotype raised in sterilized river sand were transferred into test tubes and seedlings were held in straight position by cotton plug. Three replications of each genotype were maintained along with three uninoculated test tubes of susceptible genotype T 15-15 containing only sterilized distilled water. Sterilized distilled water was added to test tubes every 48 hrs to make up the loss of water. Test tubes containing seedlings were kept in stand which is covered with black paper to prevent exposure of roots from sunlight. Observations on number of wilted plants were recorded 15 days after inoculation and subjected for statistical analysis.

Statistical analysis

The data of pot culture and water culture technique were subjected to analysis of variance for completely randomized design as described by Steel and Torrie (1980).

Results and Discussion

Pot culture screening

The incidence of disease in artificial inoculation of eight parental lines with uninoculated control checks, ranged from 0 to 90% (table 1). The disease incidence was absent in the susceptible control line T 15-15, whereas in inoculated condition, it was observed 90%. Pandey *et al.* (1996) reported survival of the susceptible and resistant genotypes 0-7% and 87-94%, respectively using this technique. The data revealed that among the genotypes screened under inoculated condition, ICP 8863 had very low (6.67%) incidence of wilt disease followed by BSMR 853 (20%). While, genotypes LRG 41, AGT 2 and ICPL 84060 had moderate incidence of disease ranging from 46.67 to 50%. The test genotypes GT 101 (80%) and AVPP 1 (70%) showed high disease incidence.

Table 1 : Per cent disease incidence in parental genotypes in pot and water culture screening techniques.

S. no.	Name of genotype	Per cent disease incidence (Mean value)	
		Pot culture screening	Water culture screening
1	T 15-15	71.57 (90.00)	91.67 (100.00)
2	LRG 41	45.00 (50.00)	91.67 (100.00)
3	ICP 84060	43.08 (46.67)	35.26 (33.33)
4	BSMR 853	26.57 (20.00)	35.26 (33.33)
5	AGT 2	45.00 (50.00)	48.24 (55.55)
6	AVPP 1	56.79 (70.00)	91.67 (100.00)
7	ICP 8863	12.29 (6.67)	8.33 (0.00)
8	GT 101	63.48 (80.00)	91.67 (100.00)
9	T 15-15 (control)	2.50 (0.00)	8.33 (0.00)
	SEm±	2.146	2.163

Values in the parenthesis are original values.

The results of the above study were in accordance with the findings of Nene (1982) where ICP 8863 was found resistant genotype in pot culture screening. Similarly, Mishra and Dhar (2005) reported that method of pot culture screening appeared to be good for creating wilt in pigeonpea *in vitro* (Prasanthi *et al*., 2009), reported a disease score of zero in treated and untreated pots of genotype ICP 8863 in pot culture screening technique for screening fusarium wilt resistant/susceptible genotypes.

Water culture screening of parental genotypes

In water culture screening, the genotypes ICP 8863 had shown no mortality due to wilt, whereas the line BSMR 853 (33.33%) and ICPL 84060 (33.33%) had shown the moderate incidence against the pathogen *Fussarium udum* (table 1). Among the eight test genotypes, AGT 2, LRG 41, T 15-15, AVPP 1 and GT 101 had moderate to high disease incidence (55.55 to

100%). Seedling mortality was not reported in uninoculated test tubes of susceptible genotype T 15-15.

The results of the above study were in accordance with the findings of Nene (1982) as he found ICP 8863 as resistant genotype in water culture screening in green house. Similarly, Pandey *et al*. (1996) also reported survival of the susceptible and resistant parents 3-8% and 94-100%, respectively using this technique for screening against fusarium wilt disease.

Conclusion

The results of pot culture screening for fusarium indicated that the genotype ICP 8863 and BSMR 853 had low disease incidence. The genotype ICPL 84060 had moderate wilt incidence while all other genotypes were susceptible to wilt disease. In water culture screening, the genotype ICP 8863 was completely free from wilt disease whereas, the genotypes BSMR 853 and ICPL 84060 had shown moderate disease incidence. The results indicated that the pot and water culture screening methods with inoculum concentration of 6.5×10^5 spore/ml are efficient for early screening of pigeonpea genotypes. The genotype ICP 8863 is resistant to fusarium wilt disease of pigeonpea and such genotype can be utilized for further breeding programme for wilt resistance.

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