

Reaction of Some Pigeonpea Varieties against Wilt Disease Complex

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ABSTRACT

Studies were undertaken for the reaction of some pigeonpea cultivars against *Heterodera cajani*, *Fusarium udum* and wilt complex (*H. cajani* + *F. udum*). Out of twelve pigeonpea varieties tested against *H. cajani*, eight varieties viz. Asha, Bennur local, BSMR-736, Chaple, GRG-811, Maruti, Pink variety and WRP-1 were found to be moderately resistant (MR), three varieties viz., Gulyal local, Katti beeja and TS-3R were found to be susceptible (S) and GS-1 variety was highly susceptible (HS). The pigeonpea varieties tested against *F. udum*, three varieties found resistant (R) (GRG-811, TS-3R and WRP-1), three varieties found moderately resistant (MR) (Asha, BSMR-736 and Maruti) and remaining varieties found susceptible (S) (Bennur local, Chaple, Gulyal local, Katti beeja, Pink variety and GS-1). Whereas, all the varieties were found susceptible to *H. cajani* and *F. udum* wilt complex condition.

Key words: *Heterodera cajani*, *Fusarium udum*, Wilt complex, Screening, Pigeonpea.

INTRODUCTION

Pigeonpea (*Cajanus cajan* (L.) Millsp.) is major pulse crop of India providing for much of the protein supplement to vegetarian population¹³. In India, it is one of the very important grain legumes and occupies second position in area and production next to chickpea. There are several constraints for the production of pulses, among them plant parasitic nematodes associated with wilt causing fungi is one of the major factors affecting the productivity of pulses. The crop suffers 13.2 per cent worldwide loss due to plant parasitic nematodes⁹. Among the diseases, wilt caused by *Fusarium udum* is the

most important soil borne disease. The disease appears on young seedlings but the highest mortality occurs during flowering and podding stage⁷.

Screening of 11 pigeonpea varieties were carried out against *H. cajani*. Out of 11 varieties, seven varieties recorded susceptible and remaining four varieties were highly susceptible⁸. Shekhappa¹² screened 27 pigeonpea varieties against *H. cajani*, among them six varieties were found moderately resistant, eighteen varieties were found to be susceptible and remaining three were found to be highly susceptible.

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The attempt was made to screen available pigeonpea varieties grown in farmers field locating source of resistance, if any, against *H. cajani*, *F. udum* and complex disease including both the pathogens.

MATERIAL AND METHODS

Seeds of locally available twelve pigeonpea varieties (Asha, Bennur local, BSMR-736, Chaple, GRG-811, GS-1, Gulyal local, Katti beeja, Maruthi, Pink variety, TS-3R, WRP-1) were obtained from Agriculture Research Station, Kalaburgi and screened for resistance to wilt complex. The seeds were sown in earthen pots containing sterilized soil and sand (1:1) mixture. The experiment was conducted under glasshouse conditions and 15 days old seedlings were inoculated with *F. udum* (25 g), *H. cajani* (1000 juveniles) and *F. udum* (25 g) + *H. cajani* (1000 juveniles) respectively and control is kept along with each variety. Treatment and varieties were replicated three times and pots were completely randomized.

Plants of all the replications were completed at 90 days after inoculation of nematodes and fungus and observations were recorded on characters of host and nematode. Also observations on shoot length, fresh shoot weight, dry shoot weight, root length, fresh root weight, dry root weight, wilt incidence and number of cysts per plant recorded. The varietal reactions were recorded by the scale given below.

Resistance ratings were recorded by using the scale given by Poonam *et al.*⁸ which is as follows:

Cyst Index	Number of cysts/plant	Reaction
1	0	HR (Highly Resistant)
2	1-5	R (Resistant)
3	6-25	MR (Moderately Resistant)
4	26-50	S (Susceptible)
5	>50	HS (Highly Susceptible)

Disease rating scale for *Fusarium* wilt of pigeonpea reported by Pande *et al.*⁵ which is as follows:

Disease incidence (%)	Disease reaction
0-10	Resistant
10.1- 20.0	Moderately resistant
20.1- 40.0	Moderately susceptible
40.1- 100	Susceptible

The per cent disease incidence was calculated by using the formula:

$$\text{Per cent disease incidence} = \frac{\text{Number of plants affected}}{\text{Total number of plants observed}} \times 100$$

RESULTS AND DISCUSSION

The results on the effect of *H. cajani*, *F. udum* and *H. cajani* + *F. udum* on growth and development of 12 varieties of pigeonpea at 90 days after inoculation are presented in Table 1.

Of the twelve varieties of pigeonpea tested against *H. cajani*, highest shoot length was recorded in a variety BSMR-736 (45.33 cm) and least by TS-3R (25.33 cm). Here, lowest fresh shoot weight by a variety which was affected by nematode is Pink variety (0.37 g) and TS-3R (0.39 g) and highest fresh shoot weight recorded by BSMR-736 (1.13 g). Highest dry shoot weight recorded by BSMR-736 (1.10 g) and least by Pink variety (0.35 g) and TS-3R (0.36 g).

Number of cysts per root system was maximum in GS-1 (67.0) followed by TS-3R (35.0) and Katti beeja (34.0) and least number of cysts per root system was recorded by Chaple (8.67) followed by Bennur local (10.67) and Maruti (13.33). Out of twelve pigeonpea varieties tested against *H. cajani*, eight varieties *viz.*, Asha, Bennur local, BSMR-736, Chaple, GRG-811, Maruti, Pink variety and WRP-1 were found to be moderately resistant (MR), three varieties *viz.*, Gulyal local, Katti beeja and TS-3R were found to be susceptible (S) and remaining one variety *i.e.*, GS-1 was highly susceptible (HS)(Table 2). The results are in conformity with the earlier workers. Sharma *et al.*¹¹ screened 60 pigeonpea genotypes against *H. cajani*. Out of these 27 were rated as susceptible and remaining were moderately resistant. Out of 15 genotypes tested against *H. cajani* only VBN-1 with 25 cysts/ plant was found to be moderately resistant and rests were highly susceptible².

Poonam *et al.*⁸ screened 11 pigeonpea varieties against *H. cajani*, out of 11 varieties, seven varieties recorded susceptible reaction and rest four were highly susceptible. In case of *F. udum* alone treatment, six pigeonpea varieties (Bennur local, Chaple, GS-1, Gulyal local, Katti beeja and Pink variety) showed susceptible (S) reaction, three varieties (Asha, BSMR-736 and Maruti) showed moderately resistant (MR) reaction and GRG-811, TS-3R and WRP-1 varieties showed resistant (R) reaction (Table 2). The results are in conformity with Parmar and Kathiria, (2015) who screened eight pigeonpea genotypes *viz.* ICP 8863, ICPL 84060, BSMR 853, AGT 2, GT 101, T 15-15, AVPP 1 and LRG 41. The wilt incidence was ranged between 0-90 per cent in the wilt sick pot culture screening technique, the genotype ICP 8863 had shown resistance against *F. udum*. Screening of 55 AICRP pigeonpea entries with a check and six Warangal (AVT and PVT) pigeonpea entries was done under wilt sick plot. Out of 60 entries, only two entries (ICPL-87119 and IPAC-68) were resistant to wilt disease¹. Field screening of more than 11000 entries of pigeonpea showed 33 lines to be resistant to *F. udum*. Only one line ICP-8863 was found to be resistant in both greenhouse and laboratory screening tests⁴.

The results on effect of *H. cajani* and *F. udum* on pigeonpea were recorded, where highest shoot length was in a variety BSMR-736 (39.67 cm) and least by TS-3R (23.33 cm). The maximum fresh shoot weight was recorded by variety Asha (0.68 g) followed by GS-1 (0.58 g) and least by Gulyal local and TS-3R (0.25 g). Maximum fresh and dry root weight was recorded by Maruti (0.13 and 0.11 g) and lowest by WRP-1 (0.05 and 0.04 g) (Table 1).

On the overall data recorded of treatments *viz.* *H. cajani*, *F. udum* and *H.*

cajani + *F. udum*, it was found that highest fresh and dry shoot weight was observed in the treatment *H. cajani* followed by *F. udum* and least by *H. cajani* + *F. udum*. Similar results were reported by Sharma and Nene^{4,10}.

The reaction of pigeonpea varieties against *H. cajani* may be due to biochemical constituents that impart resistant to the host plant. Resistant and moderately resistant varieties having more phenols and lesser total sugars, similarly susceptible varieties had less phenol content and more total sugars. In the host response of resistant and moderately resistant cultivars, the non-toxic phenolic glycosides have been shown to be hydrolysed by β -glycosidase enzyme produced by the nematode and resultant product may prevent or localize parasitization or even cause death of the nematode¹⁴.

All the varieties (Asha, Bennur local, BSMR-736, Chaple, GRG-811, GS-1, Gulyal local, Katti beeja, Maruti, Pink variety, TS-3R and WRP-1) found susceptible (S) against *F. udum* + *H. cajani* wilt complex. In the wilt susceptible genotype death was more rapid when nematode and fungus were present together. Increase in wilt incidence was observed in the presence of *H. cajani*^{4,10}. However, there is no published information available in literature on the reaction of popular cultivars of pigeonpea to *H. cajani* and *F. udum* wilt complex. Therefore, an attempt has been made to test the relative resistance/susceptibility of some popular pigeonpea cultivars to wilt disease complex under greenhouse conditions. The effect of nematode on *Fusarium* wilt expression in wilt resistant cultivars differed with the cultivar within a crop species suggesting different physiological mechanisms operating in wilt resistant cultivars³.

Table 1. Effect of *Heterodera cajani* and *Fusarium udum* alone and in combination on growth parameters, number of cysts per plant and reaction to *H. cajani* in pigeonpea

Variety/Treatments		Length		Shoot		Root		Number of cysts/ plant	Reaction
		Shoot (cm)	Root (cm)	Fresh weight(g)	Dry weight(g)	Fresh Weight(g)	Dry weight(g)		
Asha	Control	62.33	14.67	8.57	2.31	0.84	0.29	-	
	<i>H. cajani</i>	33.67	10.2	0.87	0.8	0.13	0.13	18.33	MR**
	<i>F. udum</i>	58.17	12.5	7.44	2.16	0.75	0.2	-	
	<i>F. u. + H. c.*</i>	33.33	6.17	0.68	0.37	0.09	0.08	-	
Bennur local	Control	70.33	13.27	7.8	2.37	1.45	0.47	-	
	<i>H. cajani</i>	31.0	8.67	0.45	0.35	0.1	0.07	10.67	MR
	<i>F. udum</i>	39.67	7.5	0.43	0.39	0.11	0.1	-	
	<i>F. u. + H. c.</i>	28.67	7.1	0.37	0.36	0.09	0.08	-	
BSMR-736	Control	61.0	13.17	3.6	1.38	0.93	0.44	-	
	<i>H. cajani</i>	45.33	10.63	1.19	1.18	0.44	0.25	23.67	MR
	<i>F. udum</i>	55.67	11.5	3.1	1.25	0.85	0.38	-	
	<i>F. u. + H. c.</i>	39.67	9.33	0.57	0.49	0.09	0.09	-	
Chaple	Control	54.0	10.17	4.63	1.45	0.83	0.39	-	
	<i>H. cajani</i>	33.67	7.55	0.72	0.45	0.13	0.12	8.67	MR
	<i>F. udum</i>	34.0	6.5	0.46	0.42	0.13	0.13	-	
	<i>F. u. + H. c.</i>	31.33	6.0	0.3	0.27	0.09	0.09	-	
GRG-811	Control	66.67	12.0	5.8	2.26	0.95	0.52	-	
	<i>H. cajani</i>	29.83	8.87	1.19	0.47	0.21	0.19	19.67	MR
	<i>F. udum</i>	62.33	11.7	5.58	2.02	0.86	0.44	-	
	<i>F. u. + H. c.</i>	26.33	4.5	0.31	0.29	0.11	0.1	-	
GS-1	Control	60.0	15.67	4.17	1.62	0.39	0.29	-	
	<i>H. cajani</i>	37.0	9.33	0.74	0.74	0.2	0.18	67.0	HS
	<i>F. udum</i>	42.33	7.17	0.63	0.51	0.15	0.15	-	
	<i>F. u. + H. c.</i>	34.67	6.83	0.58	0.55	0.08	0.07	-	
Gulyal local	Control	54.33	16.67	4.63	1.84	0.78	0.49	-	
	<i>H. cajani</i>	38.33	9.5	1.35	0.46	0.25	0.25	26.67	S
	<i>F. udum</i>	44.33	7.33	0.58	0.58	0.19	0.18	-	
	<i>F. u. + H. c.</i>	26.67	4.0	0.25	0.21	0.07	0.05	-	
Katti beeja	Control	56.0	10.67	3.63	1.19	0.21	0.18	-	
	<i>H. cajani</i>	37.33	10.17	0.8	0.55	0.25	0.23	34.0	S
	<i>F. udum</i>	39.67	8.83	0.53	0.52	0.11	0.1	-	
	<i>F. u. + H. c.</i>	32.33	6.0	0.52	0.49	0.11	0.08	-	
Maruti	Control	52.33	11.07	4.7	1.81	0.2	0.18	-	
	<i>H. cajani</i>	42.0	9.77	0.95	0.8	0.16	0.12	13.33	MR
	<i>F. udum</i>	48.67	9.57	4.02	1.65	0.18	0.17	-	
	<i>F. u. + H. c.</i>	38.67	6.33	0.55	0.55	0.13	0.11	-	
Pink variety	Control	55.67	11.0	3.2	1.29	0.4	0.27	-	
	<i>H. cajani</i>	32.67	8.27	0.38	0.3	0.11	0.07	19.67	MR
	<i>F. udum</i>	38.33	7.1	0.37	0.35	0.08	0.07	-	
	<i>F. u. + H. c.</i>	24.67	4.67	0.32	0.25	0.07	0.07	-	
TS-3R	Control	54.33	19.17	4.87	2.05	0.58	0.35	-	
	<i>H. cajani</i>	25.33	10.1	0.52	0.45	0.2	0.17	35.0	S
	<i>F. udum</i>	51.33	17.83	4.7	1.92	0.42	0.24	-	
	<i>F. u. + H. c.</i>	23.33	4.67	0.25	0.23	0.06	0.05	-	
WRP-1	Control	52.33	11.17	3.57	1.36	1.07	0.56	-	
	<i>H. cajani</i>	36.0	8.4	0.63	0.3	0.28	0.25	16.33	MR
	<i>F. udum</i>	50.33	10.9	3.47	1.17	0.92	0.35	-	
	<i>F. u. + H. c.</i>	24.67	5.43	0.33	0.3	0.05	0.04	-	
S.Em. ±		6.166	1.559	0.827	0.245	0.093	0.039	1.29	
C.D. at 1%		22.916	5.793	3.074	0.911	0.344	0.146	5.26	

**F. u. + H. c.* = *Fusarium udum* + *Heterodera cajani*

** HR – Highly resistant, R – Resistant, MR – Moderately resistant, S – Susceptible, HS – Highly susceptible

Table 2. Reaction of *H. cajani*, *F. udum* and *F. udum* + *H. cajani* on pigeonpea varieties

Variety	Reaction		
	<i>H. cajani</i>	<i>F. udum</i>	<i>H. cajani</i> + <i>F. udum</i>
Asha	MR	MR	S
Bennur local	MR	S	S
BSMR-736	MR	MR	S
Chaple	MR	S	S
GRG-811	MR	R	S
GS-1	HS	S	S
Gulyal local	S	S	S
Katti beeja	S	S	S
Maruti	MR	MR	S
Pink variety	MR	S	S
TS-3R	S	R	S
WRP-1	MR	R	S

R – Resistant, MR – Moderately resistant, S – Susceptible, HS – Highly susceptibl

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