Plant Archives Vol. 16 No. 1, 2016 pp. 78-82 *ISSN 0972-5210*

EVALUATION OF PIGEONPEA GENOTYPES FOR RESISTANT TO WILT CAUSED BY *FUSARIUM UDUM*

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Abstract

Pigeon pea [*Cajanus cajan* (L.) Millspaugh] is an important drought resistant pulse crop. The pigeonpea seed serves as a major dietary protein source with more than 30% of protein for large populations. Pigeonpea crop has been affected by many diseases like wilt, Sterility Mosaic Disease, Phytopthora, leaf spot etc. Among these, wilt is an one, which is directly involve in the crop loss. Wilt is caused by *Fusarium udam*, which is an soil inhabitant, survive in soil and crop deberries during the off season. The only way to avoid or become free from wilt causing fungus *i.e.*, *Fusarium udum* in pigeonpea is by developing the resistant varieties were most practical ways in India. So keeping in this view, the experiment or present investigation were conducted or carried out during 2014-15 to know theresistant entry against wilt pathogen by using different AVT-IVT, AICRP trails and pigeonpea genetic stock entries entries against pigeonpea wilt (*Fusarium udum*) sick plot developed at Agriculture Research Station, Kalburgi (UAS, Raichur) under artificial epiphytotic condition. Among the eighty entries, 18 entries WRP-1, BDN-2004-1, MAHABEJ, BRG-14-2, PT-257, BRG-14-1, MA_13, BWR-133, GRG-160, IPA-8F, KA-12-03, ICPL-87119, KPL-44, KPL-43, BSMR-571, BSMR-846, BSMR-579 and BSMR-2 were showed moderately resistant (0 to 10%), 11 entries showed moderately susceptible (10 to 20%), 27 entries were showed susceptible (20 to 50%), 24 entries were showed highly susceptible (>50%) reaction and none of the entries showed resistant reaction.

Key words : Pigeon pea [*Cajanus cajan* (L.) Millspaugh], bacterial leaf spot, *Fusarium udum*, farming system.

Introduction

Pigeon pea [*Cajanus cajan* (L.) Millsp] is widely adaptable to wide variety of climate and is one of the important legume crops of tropics and subtropics. It is an important source of protein in the cereal based vegetarian diet. It is largely consumed in the form of 'Dal'. Pigeon pea plays an important role in farming system because it fixes the atmospheric nitrogen in the soil.

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. Crop is affected by more than hundred pathogens. These includes fungi, bacteria, viruses, nematodes and mycoplasma like organisms. Major diseases of pigeonpea are, wilt (*Fusarium udum* Butler), sterility mosaic disease (virus), stem blight (*Phytophthora drechsleri* f.sp. *cajani*), root rot (*Macrophomina phaseolina*), stem canker (*Phoma cajani* and *Colletotrichum capsici*), bacterial leaf spot and canker (*Xanthomonas axonopodis* pv. *cajani*) and leaf spot (*Cercospora indica*).

Among these diseases, wilt disease caused by *Fusarium udum* Butler, is the most destructive soil and seed born disease of pigeonpea in India leading to heavy production losses. Wilt caused by *Fusarium udum* Butler was first described by Butler from India in 1906. The disease since been reported from Bangladesh, Ghana, Grenanda, Indonesia, Kenya, Malawi, Mauritius, Tanzania, Thialand, Trinida, Uganda and Zambia. The *F. udum* is host specific to pigeonpea (Patel *et al*., 2011) and can survive in soil under wilted plant stubble for a

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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.

Materials and Methods

Uniform sick plots were developed for the fast few years in 1 ha of deep block soil of the vertisol group at Agriculture Research Station, Gulberga by incorporating chopped, wilted pigeonpea plants and growing cultivars susceptible to *Fusarium udum*. As far as we have been able to acertain only one pathogenic strain is present in these uniform wilt nursery plots. Eighty (IVT-AVT, AICRP entries and pigeonpea genetic stock) entries were sown on the month of late june or early july in the uniform wilt plots with the onset of the mansoon (rainy) season and after every two rows of test entries one row of susceptible cultivar ICP- 2376 was sown to maintain a high inoculum density in the plots as well as to allow comparison of test material with a highly susceptible cultivar and also TS-3R and ICP-8863 wilt resistant check. The number of wilted plants were counted during cropping periods and data converted into disease incidence by using the formula.

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

Disease rating was done based on 1-9 scale as per Nene *et al*. (1981).

Grade	Reaction
1	Resistant (0 per cent)
3	Moderately resistant (0 – 10 per cent)
5	Moderately susceptible (10 - 20 per cent)
7	Susceptible (20-50 per cent)
9	Highly susceptible (more than 50 per cent)

Results and Discussion

Eighty (IVT-AVT, AICRP entries and pigeonpea genetic stock) pigeonpea entries were evaluated at National wilt sick plot, Agriculture Research Station, Gulberga. The observation on wilt incidence was recorded, among the eighty entries, 44 entries are from IVT-AVT lines, in that, six entries WRP-1,BDN-2004-1, MAHABEJ, BRG-14-2, PT-257 and BRG-14-1 were showed moderately resistant reaction with 0 to 10 per cent disease incidence, two entries CRG-2010-11 and AKTE-10-12 were showed moderately susceptible reaction with 10.00 to 20.00 per cent disease incidence, twenty entries RVSA-07-10, WRG-297, WRG-281, GRG-2009-1, RVSA-07-29, GRG-82, WRG-252, WRG-244, RVSA-07-31, BDN-2010-01, AKTE-12-01, GRG-K1, IPA-13-1, GRG-140, WRG-292, CRG-2013-10, WRG-289, WRG-289, WRG-246 and WRG-248 were showed susceptible reaction with 20.00 to 50.00 per cent disease incidence, sixteen entries WRG-65, RVSA-07-22, WRG-97, PUSA-20143, WRG-285, WRG-288, WRG-287, PUSA-2014-2, WRG-242, RVSA-2014-2, WRG-223WRG-286, WRG-256, PUSA-2014, WRG-296-3 and RVSA-2014-1 were showed highly susceptible reaction with more than 50.00 per cent disease incidence and none of the entries showed the resistant reaction (tables 1, 2 & 3).

26 entries are from AICRP lines, in that, six entries MA-13, BWR-133, GRG-160, IPA-8F, KA-12-03 and ICPL-87119 were showed moderately resistant reaction with 0.00 to 10.00 per cent disease incidence, five entries BGR-3, BDN-2011-1, BRG-5, TS-3R and BSMR-736 were showed moderately susceptible reaction with 10.00 to 20.00 per cent disease incidence, seven entries SKN-1005, PG-27-R, BRG-4, JAS-28IPA-15-FICP-7119 and ICPHL-4989-7 were showed susceptible reaction with 20.00 to 50.00 per cent disease incidence, eight entries TJT-501, AL-1932, PA-419, PA-426, AL-1933, AL-1758, CO-6 and KA-12-2 were showed highly susceptible reaction with more than 50.00 per cent disease incidence and none of the entries showed the resistant reaction (tables 1, 2 & 3).

10 entries are from pigeonpea genetic stock lines, in that, six entries KPL-44, KPL-43, BSMR- 571, BSMR-846,BSMR-579, and BSMR-2 were showed moderately resistant reaction with 0.00 to 10.00 per cent disease incidence, four entries BSMR-243, IPA-204, BSMR-736 and BSMR-853 showed moderately susceptible reaction with 10.00 to 20.00 per cent disease incidence and none of the entries shows susceptible, highly suceptible and resistant reaction (tables 1, 2 & 3).

The utilization of resistant varieties is a classical approach to prevent the catastrophic losses caused by wilt disease, it decreases the cost of production and increases yield. Keeping this in view, investigations on performance of pigeonpea entries against wilt disease under artificial National sick plot condition were undertaken for the year 2014-15. Among the eighty (IVT-AVT, AICRP entries and pigeon pea genetic stock) entries,

Table 1 : Screening of pigeonpea IVT-AVT, AICRP and genetic stock entries against wilt caused by *Fusarium udum* under artificial National wilt sick plot Gulberga.

S. no.	Entries	% wilt	Disease reaction	S. no.	Entries	% wilt	Disase reaction
		Mean				Mean	
	AVT				**AICRP**		
01.	RVSA-07-10	33.24	S	01.	BGR-3	14.50	MS
02.	WRG-297	31.82	S	02.	SKN-1005	44.91	S
03.	WRG-281	38.06	S	03.	TJT-501	54.61	HS
04.	WRG-65	57.55	HS	04.	AL-1932	79.61	HS
05.	RVSA-07-22	58.40	HS	05.	PG-27-R	24.52	S
06.	WRG-97	64.84	HS	06.	MA-13	17.71	MR
07.	WRP-1	08.01	MR	07.	PA-419	70.82	HS
08.	GRG-2009-1	39.27	S	08.	BWR-133	6.79	MR
09.	RVSA-07-29	28.66	S	09.	BRG-4	22.31	S
10.	PUSA-2014-3	91.25	HS	10.	JSA-28	30.47	S
11.	WRG-285	67.91	HS	11.	BDN-2011-1	11.81	MS
12.	BDN-2004-1	06.49	MR	12.	GRG-160	3.6	MR
13.	CRG-2010-11	12.07	MS	13.	PA-426	66.70	HS
14.	WRG-288	56.95	HS	14.	AL-1933	67.95	HS
15.	GRG-82	22.50	S	15.	IPA-8F	5.01	MR
16.	WRG-287	73.26	HS	16.	AL-1758	71.71	HS
17.	MAHABEJ	2.60	MR	17.	KA-12-03	17.55	MR
18.	WRG-252	27.96	S	18.	IPA-15-F	27.24	S
19.	PUSA-2014-2	80.70	HS	19.	CO-6	92.50	HS
20.	WRG-244	48.83	S	20.	BRG-5	11.22	MS
21.	WRG-242	64.64	HS	21.	KA-12-2	50.07	HS
22.	RVSA-07-31	34.85	S	22.	TS-3R	15.58	MS
23.	RVSA-2014-2	67.33	HS	23.	BSMR-736	16.83	MS
24.	WRG-223	53.38	HS	24.	ICP-7119	35.5	S
25.	WRG-286	68.71	HS	25.	ICPL-87119	5.56	MR
26.	BDN-2010-01	25.18	S	26.	ICPHL-4989-7	32.67	S
27.	AKTE-12-01	21.92	S		**Pigeonpea genetic stock**		
28.	AKTE-10-12	19.39	MS	01.	KPL-44	6.03	MR
29.	WRG-256	65.97	HS	02.	BSMR-243	14.46	MS
30.	GRG-K1	31.65	S	03.	KPL-43	6.57	MR
31.	IPA-13-1	23.44	S	04.	BSMR-571	2.59	MR
32.	GRG-140	35.82	S	05.	IPA-204	11.51	MS
33.	WRG-292	29.43	S	06.	BAMR-846	6.08	MR
34.	PUSA-2014	55.84	HS	07.	BSMR-579	4.51	MR
35.	CRG-2013-10	45.40	S	08.	BSMR-736	19.08	MS
36.	WRG-289	39.95	S	09.	BSMR-2	9.19	MR
37.	WRG-293	54.41	HS	10.	BSMR-853	14.45	MS
38.	WRG-246	40.88	S				
39.	WRG-248	42.84	S				
40.	RVSA-2014-1	64.62	HS				
	AVT				**Check entries**		
41.	BRG-14-2	4.20	MR	1.	TS-3R (WRC)	8.49	MR
42.	PT-257	9.56	MR	2.	ICP-8863 (WRC)	9.48	MR
43.	BRG-14-1	5.28	MR	3.	ICP2376 (WSC)	80.08	HS
44.	PT-307-1	29.22	S				

Table 2 : Reaction of different pigeonpea entries against wilt under artificial epiphytic condition.

S. no.	Name of the entries	Resistant (up to 0%)	Moderate resistant (0% to 10%)	Moderate susceptible (10% to 20%)	Susceptible (20% to 50%)	Highly susceptible (> 50%)	Total
1.	IVT-AVT	-	WRP-1, BDN-2004-1, MAHABEJ, BRG-14-2, PT-257, BRG-14-1	CRG-2010-11 and AKTE-10-12	RVSA-07-10, WRG-297, WRG-281, GRG-2009-1, RVSA-07-29, GRG-82,WRG-252, WRG-244, RVSA-07-31, BDN-2010-01, AKTE-12-01, GRG-K1, IPA-13-1, GRG-140, WRG-292, CRG-2013-10, WRG-289, WRG-289, WRG-246 and WRG-248	WRG-65, RVSA-07-22,WRG-97,PUSA-20143, WRG-285,WRG-288,WRG-287, PUSA-2014-2, WRG-242, RVSA-2014-2,WRG-223WRG-286,WRG-256,PUSA-2014,WRG-296-3 and RVSA-2014-1	44
2.	AICRP	-	MA-13, BWR-133, GRG-160, IPA-8F, KA-12-03, ICPL-87119	BGR-3,BDN-2011-1,BRG-5, TS-3R and BSMR-736	SKN-1005, PG-27-R, BRG-4, JAS-28IPA-15-FICP-7119 and ICPHL-4989-7	TJT-501, AL-1932,PA-419,PA-426, AL-1933, AL-1758,CO-6 and KA-12-2	26
3.	Pigeonpea genetic stock	-	KPL-44, KPL-43, BSMR- 571, BSMR-846,BSMR-579 and BSMR-2	BSMR-243, IPA-204,BSMR-736 and BSMR-853	-	-	10
	Total						80

Table 3 : Reaction of pigeonpea entries against wilt under artificial National sick plot Gulberga.

Grade	Reaction	Entries
1	Resistant (0 per cent)	-
3	Moderately resistant (0 – 10 per cent)	WRP-1,BDN-2004-1, MAHABEJ, BRG-14-2, PT-257, BRG-14-1, MA-13, BWR-133, GRG-160, IPA-8F, KA-12-03 , ICPL-87119, KPL-44, KPL-43, BSMR- 571, BSMR-846,BSMR-579, and BSMR-2
5	Moderately susceptible (10 - 20 per cent)	CRG-2010-11,AKTE-10-12,BGR-3,BDN-2011-1,BRG-5, TS-3R, BSMR-736, BSMR-243, IPA-204,BSMR-736 and BSMR-853
7	Susceptible (20-50 per cent)	RVSA-07-10,WRG-297,WRG-281,GRG-2009-1, RVSA-07-29, GRG-82,WRG-252,WRG-244,RVSA-07-31,BDN-2010-01,AKTE-12-01, GRG-K1, IPA-13-1,GRG-140, WRG-292, CRG-2013-10, WRG-289, WRG-289, WRG-246, WRG-248, SKN-1005, PG-27-R, BRG-4,JAS-28IPA-15-FICP-7119 and ICPHL-4989-7
9	Highly susceptible (> 50 per cent)	WRG-65, RVSA-07-22,WRG-97,PUSA-20143, WRG-285,WRG-288,WRG-287, PUSA-2014-2, WRG-242, RVSA-2014-2,WRG-223WRG-286,WRG-256,PUSA-2014,WRG-296-3, RVSA-2014-1, TJT-501, AL-1932,PA-419,PA-426, AL-1933, AL-1758,CO-6 and KA-12-2

18 entries were showed moderately resistant reaction with with 0.00 to 10.00 per cent disease incidence, 11 entries were showed moderately susceptible reaction with 10.00 to 20.00 per cent disease incidence, 27 entries were showed susceptible reaction with 20.00 to 50.00 per cent disease incidence and 24 entries showed highly susceptible reaction with more than 50.00 per cent disease incidence and none of the entries showed the resistant reaction.

Out of eighty entries evaluated under sick plot, 18 entries WRP-1, BDN-2004-1, MAHABEJ, BRG-14-2, PT-257, BRG-14-1, MA_13, BWR-133, GRG-160, IPA-8F, KA-12-03, ICPL-87119, KPL-44, KPL-43, BSMR-571, BSMR-846, BSMR-579 and BSMR-2 were showed moderately resistant reaction with with 0.00 to 10.00 per cent disease incidence. 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 same findings *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.

Among the eighty entries, WRP-1, BDN-2004-1, MAHABEJ, BRG-14-2, PT-257, BRG-14-1, MA_13, BWR-133, GRG-160, IPA-8F, KA-12-03, ICPL-87119, KPL-44, KPL-43, BSMR-571, BSMR-846, BSMR-579, and BSMR-2 were showed moderately resistance reaction so that these lines can be used for exploitated for further development of resistant varieties through breeding programme.

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