

Screening of Pigeonpea Genotypes and Host Differentials Against Wilt Incited by *Fusarium Udum* Butler

S. G. ASHITHA, H. K. RAMAPPA AND M. BYRE GOWDA

Department of Plant Pathology, College of Agriculture, UAS, GKVK, Bengaluru - 560 065

ABSTRACT

One hundred and thirty two pigeonpea genotypes were screened for resistance against *Fusarium* wilt in the sick plots maintained at AICRP on pigeonpea, ZARS, GKVK Bengaluru during *kharif* 2014-15. Observations on wilt incidence were recorded at 7 days interval starting from 30 days after sowing up to 180 days. Among 122 pigeonpea genotypes evaluated against *Fusarium* wilt, forty seven genotypes showed resistance reaction with 0-10 per cent disease incidence. Among the ten host differentials screened, five host differentials BDN 2, C11, ICP 8858, ICP 8863 and ICP 9174 showed resistant reaction with 0.0 to 10.00 per cent wilt incidence. The promising genotypes with *Fusarium* wilt resistance may be used as donors in breeding programme to develop high yielding varieties having disease resistance. Genotypes which are high yielding as well as disease resistant could be tested further for their stability across location and released as a variety.

PIGEONPEA (*Cajanus cajan* [L.] Millspaugh) is an important food legume (or pulse) crop that is predominantly cultivated in tropical and subtropical regions of the world. It is known as arhar, tur and red gram. It is nutritionally rich and contains 22 per cent protein, 1.7 per cent fat, 7.3 per cent calcium apart from Vit. A and B-complex in traces (Dhage *et al.*, 2014) and supplies a major share of protein requirement of vegetarian population of the country. The main constraints in boosting the yield of pigeonpea crop are its susceptibility to diseases, insects and other physiological stresses. Among the diseases wilt caused by *Fusarium udum* Butler is one of the main concern which affects stability in production; In severe condition it causes loss up to 100 per cent in susceptible genotypes depending up on the stage at which crop is attacked (Kannaiyan and Nene, 1981). The fungus can survive on infected plant debris in the soil for about three years and cause serious yield losses, sometimes 100 per cent in susceptible cultivars (Kiprop *et al.*, 2002). Annual losses due to *Fusarium* wilt in pigeonpea crop have been estimated at US \$ 71 million in India (Reddy *et al.*, 2012). As pigeonpea wilt is emerging as an important constraint in pigeonpea production, host plant resistance is the most reliable, economical and effective method for managing the disease. Keeping this in view one hundred and thirty two pigeonpea genotypes were evaluated under wilt sick plot conditions during *kharif* 2014-15. Later genotypes

were categorized into disease resistant, moderately resistant and susceptible based on final wilt disease incidence.

MATERIAL AND METHODS

One hundred and thirty two pigeonpea genotypes were screened for resistance against *Fusarium* wilt in the sick plots maintained at AICRP on pigeonpea, ZARS, GKVK, Bengaluru during *kharif* 2014 - 15. The field experiment was laid out in randomized complete block design with spacing of 60 x 20 cm in two replications. Each genotype was sown in 2 rows of 5 m row length. Each test entries were alternated by susceptible check ICP 2376. Observations on wilt incidence were recorded at 7 days interval starting from 30 days after sowing up to 180 days. Maximum wilt incidence on 180th day was taken to categorize the genotypes to different disease classes as per the disease scoring scale adopted by AICRP on pulses.

The following formula was used to calculate disease incidence

$$\text{Disease incidence (\%)} = \frac{\text{No. of plants infected}}{\text{Total number of plants examined}} \times 100$$

The following AICRP scale was adopted for evaluating the genotypes against wilt disease incidence.

Wilt incidence (per cent)	Reaction
0.00 - 10.00	: Resistant
10.10 -30.00	: Moderately resistant
>30.00	: Susceptible

RESULTS AND DISCUSSION

Reaction of AVT and IVT pigeonpea genotypes against *Fusarium wilt* : Out of 63 genotypes evaluated against *Fusarium wilt* ten genotypes viz., BDN 2004-1, BDN 2010-1, BRG14-1, GRGK1, GRG 140, BRG 5, GRG 160, MAHABEEJ 105, ICP 8863 and IPA13-1 showed resistance reaction with 0-10 per cent disease incidence as indicated in the Table I and II. Eight genotypes viz., AKTE 12-1, BDN 2011-1,

TABLE I

Reaction of IVT and AVT pigeonpea genotypes against *Fusarium wilt* during Kharif 2014

Entry	Plant stand (Nos.)	Wilted Plants (Nos.)	Mean Wilt Incidence (%)	Reaction
AKTE 12-1	41	10	24.39	MR
AKTE 10-12	50	33	66.00	S
AL 1758	67	64	95.52	S
AL 1932	47	47	100.00	S
AL 1933	27	26	96.30	S
BAU 13-1	26	12	46.15	S
BDN 2004-1	13	0	0.00	R
BDN 2010-1	12	0	0.00	R
BDN 2011-1	10	3	30.00	MR
BRG 14-2	18	2	11.11	MR
BRG 2	28	12	42.86	S
BRG 14-1	10	0	0.00	R
BRG 5	59	5	08.47	R
BSMR 2	41	9	21.95	MR
CRG 2010-11	21	13	61.90	S
CRG 2013-10	41	40	97.56	S
GRG 140	45	1	2.22	R
GRG 2009-1	47	33	70.21	S
GRG 84	62	46	74.19	S
GRG 160	56	2	3.57	R
GRGK 1	38	0	0.00	R
ICP 2376	42	42	100.00	S
ICP 8863 (Maruthi)	67	5	7.46	R

Entry	Plant stand (Nos.)	Wilted Plants (Nos.)	Mean Wilt Incidence (%)	Reaction
ICPHL 4989-7	64	31	48.44	S
IPA 13-1	37	1	2.70	R
JSA 28	58	26	44.83	S
KA 12-2	45	31	68.89	S
KA 12-3	57	35	61.40	S
MAHABEEJ 105	57	1	1.75	R
PA 419	41	40	97.56	S
PA 426	47	46	97.87	S
PG 27R	74	9	12.16	MR
PT 257	46	10	21.74	MR
PT 307-1	72	52	72.22	S
PUSA 2014	39	38	97.44	S
PUSA 2014-2	38	36	94.74	S
PUSA 2014-3	48	42	87.50	S
RVSA 2014-1	14	12	85.71	S
RVSA 07-22	25	24	96.00	S
RVSA 07-29	9	5	55.56	S
RVSA 07-31	31	28	90.32	S
RVSA 2014-2	32	20	62.50	S
RVSA-07-10	24	15	62.50	S
SKND 1205	27	27	100.00	S
TJT 501	64	16	25.00	MR
WRG 220	41	40	97.56	S
WRG 242	32	31	96.88	S
WRG 244	94	77	81.91	S
WRG 246	63	31	49.21	S
WRG 252	39	37	94.87	S
WRG 256	59	33	55.93	S
WRG 280	43	16	37.21	S
WRG 286	49	43	87.76	S
WRG 287	54	53	98.15	S
WRG 288	47	28	59.57	S
WRG 289	48	46	95.83	S
WRG 292	70	62	88.57	S
WRG 293	16	13	81.25	S
WRG 297	62	38	61.29	S
WRG 65	60	52	86.67	S
WRG 97	61	55	90.16	S
WRG 223	58	36	62.07	S
WRG 248	49	42	24.39	MR
Location severity Index (LSI)			60.77	

R : Resistant
 MR : Moderately resistant
 S : Susceptible

TABLE II

Grouping of IVT-AVT Pigeonpea genotypes against Fusarium wilt disease

Reaction	Entries	No. of Entries
Resistant (0.00-10.00%)	BDN 2004-1, BDN 2010-1, BRG14-1, BRG 5, GRGK 1, GRG 140, (0.00-10.00%) GRG 160, MAHABEEJ 105, ICP 8863(Maruthi) and IPA 13-1	10
Moderately resistant (10.10-30.00%)	AKTE 12-1, BDN 2011-1, BRG 14-2, BSMR 2, PG 27 R, PT 257, TJT 501 and WRG 248	8
Susceptible (>30%)	AKTE 10-12, AL1758, AL 1932, AL1933, BAU 13-1, BRG 2, CRG 2010-11, CRG 2013-10, GRG 2009-1, GRG 84, ICP 2376, CPHL 4989-7, JSA 28, KA 12 -2, KA 12-3, PA 419, PA 426, PT 3071, PUSA 2014, PUSA 2014-2, PUSA 2014-3, RVSA 2014-1, 4 5 RVSA 07-22, RVSA 07-29, RVSA 07-31, RVSA 2014-2, RVSA-07-10, SKND 1205, WRG 220, WRG 242, WRG 244, WRG 246, WRG 252, WRG 256, WRG 280, WRG 286, WRG 287, WRG 288, WRG 289, WRG 292, WRG 293, WRG 297, WRG 65, WRG 97 and WRG 223	63
Total no. of entries		83

BRG 14-2, BSMR 2, PG 27 R, PT 257, TJT 501 and WRG 248 showed moderately resistant reaction with 10.10-30.00 per cent disease incidence. The remaining genotypes *viz.*, AKTE 10-12, AL1758, AL 1932, AL1933, BAU 13-1, BRG 2, CRG 2010-11, CRG 2013-10, GRG 2009-1, GRG 84, ICPHL 4989-7, JSA 28, KA 12 -2, KA 12-3, PA 419, PA 426, PT 3071, PUSA 2014, PUSA 2014-2, PUSA 2014-3, RVSA 2014-1, RVSA 07-22, RVSA 07-29, RVSA 07-31, RVSA 2014-2, RVSA-07-10, SKND 1205, WRG 220, WRG 242, WRG 244, WRG 246, WRG 252, WRG 256, WRG 280, WRG 286, WRG 287, WRG 288, WRG 289, WRG 292, WRG 293, WRG 297, WRG 65, WRG 97, WRG 223 and WRG 248 showed susceptible reaction with disease incidence of more than 30 per cent. The susceptible check ICP 2376 showed susceptible reaction with 100 per cent wilt incidence.

Reaction of state and centrally released pigeonpea varieties against Fusarium wilt : Among the twenty nine state and centrally released varieties MA13, BSMR 579, IPA 204, IPA 8 F, BRG 3, BDN 2, BSMR 853, KPL 43, WRP 1, BSMR 571, ICP 8863, BSMR 243, BSMR 846, BWR 133, ICP 87119 and KPL 44 were resistant with 0-10 per cent disease incidence.

The genotypes *viz.*, BSMR 736, MA 6 and JKM 189 were moderately resistant with 10.10 to 30.00 Per

cent disease incidence. Ten genotypes *viz.*, Bahar, BRG 2, BRG 4, BRG 1, CO 6, CORG 97010, ICP 7119, IPA 15 F, VIPULA and ICP 2376 showed susceptible reaction with disease incidence of more than 30 per cent (Table III and IV).

Reaction of ICRISAT pigeonpea genotypes against Fusarium wilt disease : Among the thirty genotypes screened against wilt disease, 21 genotypes *viz.*, ICP 11376, ICP 12012, ICP 12739, ICP 13361, ICPL 20095, ICPL 20123, ICPL 20124, ICPL 20135, ICPL 20137, ICPL 87051, ICPL 90011, ICPL 94062, ICPL 96053, ICPL 96061, ICPL 99044, ICPL 99055, ICPL 99091, ICPL 99098, ICP 99009, ICP 8863 and ICP 12728 showed resistant reaction, with 0-10 Per cent disease incidence and two genotypes *viz.*, ICPL 99100 and ICPL 99048 showed moderately resistant reaction with 10.10-30.00 per cent disease incidence and remaining seven genotypes *viz.*, ICP 2376, ICP 12752, ICPL 20119, ICPL 20136, ICPL 99008, ICPL 99095 and ICPL 99099 showed susceptible reaction with wilt incidence of more than 30 per cent (Table V).

Reaction of pigeonpea host differentials against Fusarium udum : Among the ten host differentials screened to identify *Fusarium udum* isolate prevailing at Bengaluru, five host differentials BDN 2, C11, ICP 8858, ICP 8863 (Maruthi) and ICP 9174 showed resistant reaction with 0.0 to 10.00 per cent wilt incidence. Genotype ICP 8859 showed

TABLE III

Reaction of state and centrally released pigeonpea varieties against Fusarium wilt disease during Kharif 2014

Entry	Plant stand (Nos.)	Wilted Plants (Nos.)	Mean Wilt Incidence (%)	Reaction
BAHAR	21	21	100.00	S
BDN 2	21	1	04.76	R
BRG 2	22	21	95.45	S
BRG 3	9	0	0.00	R
BRG 4	25	22	88.00	S
BRG 1	14	14	100.00	S
BSMR 243	27	0	0.00	R
BSMR 579	29	2	6.90	R
BSMR 736	17	4	23.53	MR
BSMR 846	9	0	0.00	R
BSMR 571	9	0	0.00	R
BSMR 853	18	1	5.56	R
BWR 133	15	0	0.00	R
CO 6	27	27	100.00	S
CORG 97010	42	21	50.00	S
ICP 7119	3	1	33.33	S
IPA 204	15	1	6.67	R
IPA 8F	25	2	8.00	R
IPA 15 F	30	28	93.33	S
JKM 189	24	7	29.17	MR
KPL43	27	1	3.70	R
KPL 44	16	0	0.00	R
MA13	25	2	8.00	R
MA 6	34	6	17.65	MR
VIPULA	30	20	66.67	S
WRP 1	16	0	0.00	R
ICP 87119	6	0	0.00	R
ICP 8863(Maruthi)	16	1	6.25	R
ICP 2376	28	28	100.00	S
Location Severity Index (LSI)			32.65	

R : Resistant MR : Moderately resistant S : Susceptible

TABLE V

Reaction of ICRISAT pigeonpea genotypes against Fusarium udum during Kharif 2014

Entry	Plant stand (Nos.)	Wilted Plants (Nos.)	Mean Wilt Incidence (%)	Reaction
ICP 11376	9	0	0.0	R
ICP 12012	8	0	0.0	R
ICP 12728	10	0	0.0	R
ICP 12739	10	0	0.0	R
ICP 13361	7	0	0.0	R
ICP 2376	10	8	80.0	S
ICP 8863	8	0	0.0	R
ICP 12752	4	2	50.0	S
ICPL20095	5	0	0.0	R
ICPL 20119	13	5	38.46	S
ICPL 20123	5	0	0.0	R
ICPL 20124	3	0	0.0	R
ICPL 20135	10	0	0.0	R
ICPL 20136	7	3	42.86	S
ICPL 20137	5	0	0.0	R
ICPL 87051	3	0	0.0	R
ICPL 90011	4	0	0.0	R
ICPL 94062	9	0	0.0	R
ICPL 96053	7	0	0.0	R
ICPL 96061	10	0	0.0	R
ICPL 99008	12	6	50.0	S
ICPL 99009	2	0	0.0	R
ICPL 99044	6	0	0.0	R
ICPL 99048	14	3	21.43	MR
ICPL 99055	2	1	50.0	S
ICPL 99099	11	9	81.82	S
ICPL 99091	6	0	0.0	R
ICPL 99095	9	3	33.33	S
ICPL 99098	4	0	0.0	R
ICPL 99100	12	3	25.0	MR
Location Severity Index (LSI)			15.76	

R : Resistant MR : Moderately resistant S : Susceptible

TABLE IV

Grouping of state and centrally released pigeonpea varieties against Fusarium wilt disease

Reaction	Entries	No. of Entries
Resistant (0.00-10.00%)	MA13, BSMR 579, IPA 204, IPA 8 F, BRG 3, BDN 2, BSMR 853,(0.00-10.00%) KPL 43, WRP 1, BSMR 571, BSMR 243, BSMR 846, BWR 133, ICP 87119, ICP 8863 and KPL 44	16
Moderately resistant (10.10-30.00%)	BSMR 736, MA 6 and JKM 189	3
Susceptible(>30%)	Bahar, BRG 2, BRG 4, BRG 1, CO 6, CORG 97010, ICP 7119, IPA 15 F, VIPULA and ICP 2376	10
Total No. of entries		29

TABLE VI
Grouping of ICRISAT Pigeonpea genotypes against Fusarium wilt disease

Reaction	Entries	No. of genotypes
Resistant 0.00-10.00%)	ICP 11376, ICP 12012, ICP 12739, ICP 13361, ICPL 20095, ICPL 20123, ICPL 20124 ICPL 20135, ICPL 20137, ICPL 87051, ICPL 90011, ICPL 94062, ICPL 96053, ICPL 96061, ICPL 99044, ICPL 99055, ICPL 99091, ICP 99009, ICPL 99098, ICP 8863 and ICP 12728	21
Moderately resistant (10.10-30.00%)	ICPL 99100 and ICPL 99048	2
Susceptible(>30%)	ICP 2376, ICP 12752, ICPL 20119, ICPL 20136, ICPL 99008, ICP 99095 and ICPL 99099	7
Total No. of entries		30

moderately resistant reaction and the remaining four genotypes *viz.*, Bahar, BDN 1, ICP 2376 and ICP 8862 were susceptible with more than 30 per cent wilt incidence (Table VII).

The use of resistant cultivars is widely recognized as the safest, most economical and most effective method for protecting crops from disease (Johnson and Jellis, 1992). The results obtained in field evaluation of pigeonpea genotypes against *Fusarium udum* are in agreement with the results given by several workers who identified resistant genotypes against *Fusarium* wilt disease.

Genotype ICPL-87119 (Asha) was found to perform better with zero per cent disease incidence. The same genotypes have been evaluated for *Fusarium* wilt at ICRISAT Centre between 1989-90 and 1991-92 cropping seasons (Anon., 1993). The mean wilt incidence for ICPL 87119 was 2 per cent compared with 56 per cent in the control C 11 and 97 per cent in the wilt-susceptible control ICP 2376. It has also shown resistance to wilt disease at other endemic areas of Karnataka, Maharashtra, and Gujarat states in India. Nene *et al.* (1989) reported the genotypes ICP 8863, C 11 and BDN 1 were found resistant against *Fusarium* wilt in India. Haque *et al.* (1984) reported the resistance of a genotype *viz.*, ICP 8863 against *Fusarium udum* as the genotype recorded a wilt incidence of only 5 per cent in wilt sick plots situated in Ranchi. Konda *et al.* (1986) reported that a pigeonpea variety ICP 8863, which was released under the name 'Maruthi' performed better in wilt affected

TABLE VII

Reaction of pigeonpea host differentials to F. udum

Entry	Plant stand (Nos.)	Wilted Plants (Nos.)	Mean Wilt Incidence (%)	Reaction
Bahar	35	34	97.14	S
BDN1	44	23	52.27	S
BDN2	24	2	08.33	R
C 11	46	4	08.69	R
ICP 2376	46	46	100.00	S
ICP 8858	36	3	08.33	R
ICP 8859	15	3	20.00	MR
ICP 8862	29	25	86.21	S
ICP 8863	58	5	08.62	R
ICP 9174	27	2	07.40	R
Location Severity Index			39.70	

R : Resistant MR : Moderately resistant S : Susceptible

areas of Karnataka. Anjaneya Reddy and Saifulla (2005) screened several pigeonpea genotypes and reported BSMR 853, ICP 87119, ICPL 96061 and ICPL 99055 as resistant with 0-10.00 per cent wilt incidence, the present study is in confirmity with this report. Saifulla *et al.* (2008) reported that the pigeonpea genotypes, ICP 87119, ICPL 93001, ICPL 96047, ICPL 99055, ICPL 99046, ICPL 96061 and C 11 showed

resistant reaction with 0-10 per cent incidence, whereas susceptible check TTB 7 showed susceptible reaction with >50 per cent incidence during screening for seven years (2000-01 to 2006-07). Among eleven host differentials screened against *Fusarium udum*, for four years, six host differentials viz., ICP 9174, C 11, ICP 8863, ICP 87119, ICP 8859 and ICP 8858 showed resistant reaction with mean wilt incidence of 0.59, 1.68, 2.17, 2.70, 8.36 and 8.59 per cent, respectively.

Present study is in line with the findings of Asha *et al.*, (2012) who reported that the genotypes BSMR 853, KPL 43, KPL 44, IPA 204, ICPL 87119, ICPL 99044 and ICPL 99088 showed resistant reaction against *Fusarium udum* under sick plot conditions. Among the ten host differentials screened to identify *Fusarium udum* isolate prevailing at Bangalore, five host differentials viz., BDN 2, C11, ICP 8858, ICP 8863, and ICP 9174 showed resistant reaction with 0.0 to 10.00 per cent wilt incidence. Genotype ICP 8859 showed moderately resistant reaction and the remaining four genotypes viz., Bahar, BDN 1, ICP 2376 and ICP 8862 were susceptible with more than 30 per cent wilt incidence. The resistant reaction of C 11, ICP 8863, ICP 9174 and susceptible reaction of ICP 2376 indicated the presence of strain 1 of *F. udum*. Asha *et al.* (2012) also reported the possibility of strain 1 of *Fusarium udum* in Bengaluru. Several resistant pigeonpea genotypes to *Fusarium udum* have been reported by various workers in previous studies (Baldev and Amin, 1974; Rajkule *et al.*, 1989; Nene and Kannaiyan, 1982; Zaveri *et al.*, 1986; Nene *et al.*, 1989; Reddy *et al.*, 1989, 1990; Gwata *et al.*, 2006).

The results revealed that among the tested genotypes varying levels of resistance or susceptibility against *F. udum* is present. This may be due to higher activity of defense related enzymes and other pathogen inhibiting compounds in resistant genotypes compared to susceptible genotypes. Murthy (1975) observed that resistance was associated with higher contents of total sugars, reducing sugars, amino nitrogen, amino acids, phenols, flavanols, alkaloids, xylose, cystine, tryptophan, but, lower amount of phenylalanine in pigeonpea genotypes. According to Chaudhary and Kumar (2000) susceptibility could be due to higher root thickness and wider vascular bundles in susceptible genotypes than

resistant genotypes. Chakraborty and Sengupta (2001) reported that *Fusarium* wilt resistance is correlated with the increase in activity of defence enzymes viz., polygalacturonase and peroxidase in resistant pigeonpea cultivars.

REFERENCES

- ANJANEYA REDDY, B. AND SAIFULLA, M., 2005, Evaluation of promising pigeonpea genotypes and host differentials against *Fusarium udum* Butler. *Karnataka J. Agric. Sci.*, **18** (3) : 691 - 693.
- Anonymous, 1993, Pigeonpea Variety ICPL 87119. Plant Material Description No. 43, ICRISAT, 1 - 4 pp.
- ASHA, S. M., RAMAPPA, H. K. AND GOWDA, M. B., 2012, Screening of pigeonpea genotypes for resistance to *Fusarium* wilt. *Mysore J. Agric. Sci.*, **46** (3) : 563-566.
- BALDEV, B. AND AMIN, K. S., 1974, Studies on the existence of races in *Fusarium udum* causing wilt of *Cajanus cajan*. *SABRAO J.*, **6** (2) : 201 - 205.
- CHAKRABORTY, A. AND SENGUPTA, P. K., 2001, Some biochemical changes in susceptible pigeonpea seedlings in response to inoculation with non-pathogenic *Fusaria* and its significance in inducing resistance against *Fusarium* wilt. *J. Mycol. Pl. Pathol.*, **31** (1) : 42 - 45.
- CHAUDHARY, R. G. AND KUMAR, K., 2000, Role of width of xylem and root vascular bundles of pigeonpea in resistance to wilt. *Annals of Plant Protect. Sci.*, **8** : 102 - 104.
- DHAGE, S. A., GUPTA, V. R., MANE, S. S. AND SURYAWANSHI, K. K., 2014, Molecular analysis of isolates of *Fusarium udum* causing pigeonpea wilt through RAPD and ISSR. *Journal of Cell and Tissue Research*, **14** (2) : 4449 - 4454.
- GWATA, E. T., SILIM, S. N. AND MGOJJA, M., 2006, Impact of a new source of resistance to *Fusarium* wilt in pigeonpea. *J. Phytopathol.*, **154** : 62 - 64.
- HAQUE, M. F., JHA, D. K., MUKHERJEE, A. K., VAN DER MAESEN, L. J. G. AND KANNAIYAN, J., 1984, Evaluation of ICRISAT germplasm for wilt incidence in the Plateau region of Chota Nagpur in India. *Inter. pigeonpea Newsl.*, **3** : 36 - 37.

- JOHNSON, R. AND JELLIS, G. J., 1992, Development in Plant Pathology, *In: Breeding for Disease Resistance*. Kluwer Academic, Dordrecht, The Netherlands, **1**: 205.
- KANNAIYAN, J. AND NENE, Y. L., 1981B, Influence of wilt at different growth stages on yield loss in pigeonpea, *Trop. Pest Manage.*, **27** (1): 141.
- KIPROP, E. K., BAUDOIN, J. P., MWANGOMBE, A. W., KIMANI, P. M., MERGEAI, G. AND MAQUET, A., 2002, Characterization of Kenyan isolates of *Fusarium udum* from pigeonpea [*Cajanus cajan* (L.) Millsp.] by cultural characteristics, aggressiveness and AFLP analysis. *J. Phytopathol.*, **150** (10): 517 - 525.
- KONDA, C. R., PARAESWARAPPA, R. AND SWAMI RAO, T., 1986, Pigeonpea ICP 8863, A boon to *Fusarium* wilt endemic areas of Karnataka. *Inter. pigeonpea Newsl.*, **5**: 36 - 37.
- MURTHY, G. S., 1975, Studies on the nature of resistance in *Cajanus cajan* (L.) Millsp. against wilt caused by *Fusarium udum* Butl. *Mysore J. Agric. Sci.*, **9**: 716-717.
- NENE, Y. L. AND KANNAIYAN, J., 1982, Screening pigeonpea for resistance to *Fusarium* wilt. *Pl. Dis.*, **66** (4): 306-307.
- NENE, Y. L., KANNAIYAN, J., REDDY, M. V., ZOTE, K. K., MAHMOOD, M., HIREMATH, R. V., SHUKLA, P., KOTASTHANE, S. R., SENGUPTA, K., JHA, P. K., HAQUE, M. F., GREWAL, J. S. AND MAHENDRAPAL, 1989, Multilocal testing of pigeonpea for broad resistance to *Fusarium* wilt resistance in India. *Indian Phytopath.*, **42**: 449 - 453.
- RAJKULE, P. N., GOYAL, S. N. AND VALA, D. G., 1989, Screening of pigeonpea varieties against *Fusarium* wilt. *Inter. pigeonpea Newsl.*, **9**: 24 - 25.
- REDDY, M. V., RAJU, T. N., SHARMA, S. B., NENE, Y. L., MCDONALD, D., PANDE, S. AND SHARMA, M., 2012, *Handbook of Pigeonpea Diseases (Revised)*. Inf. Bull. No. 42. Patancheru, A. P. India: ICRISAT. 64pp.
- REDDY, M. V., NENE, Y. L., KANNAIYAN, J., RAJU, T. N., SAKA, V. N., DAVOR, A. T., SONGA, W. P. AND OMANGA, P., 1990, Pigeonpea lines resistant to wilt in Kenya and Malawi. *Inter. Pigeonpea Newsl.*, **6**: 34.
- REDDY, M. V., NENE, Y. L., RAJU, T. N., SHEILA, V. K., KANNAIYAN, J. AND BENIWAL, S. P. S., 1989, Evaluation of pigeonpea lines for resistance to wilt, sterility mosaic and *Phytophthora* blight. *Inter. pigeonpea Newsl.*, **10**: 22 - 23.
- SAIFULLA, M., MAHESH, M. AND GOWDA, M. B., 2008, Evaluation of pigeonpea genotypes and host differentials against wilt caused by *Fusarium udum* Butler. *Trends in Biosciences*, **1** (1): 22 - 24.
- ZAVERI, P. P., SHAH, R. M., PATHAK, J. A., PATEL, J. A. KHER, H. R., PATEL R. S. AND TIKKA, S. B. S., 1986, BDN 2 a wilt tolerant superior cultivar of pigeonpea for Gujarat. *Inter. pigeonpea Newsl.*, **5**: 38 - 39.

(Received : September, 2015 Accepted : December 2015)