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Field Evaluation of Pigeonpea Genotypes against Pigeonpea Sterility Mosaic Virus (PPSMV)

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ABSTRACT

Pigeonpea genotypes obtained from ICRISAT and AICRP centers were evaluated under field condition during Kharif 2015 for resistance to PPSMV at ZARS, GKVK, UAS, Bengaluru, to identify the resistant source. Ten advanced varietal trial entries tested against SMD. None of the entries showed resistant reaction or moderately resistant reaction to SMD. Their disease incidence varied from 82 to 100%. Out of 22 IVT medium duration entries, none of the entries showed resistant reaction but all were showed more than 50 per cent disease incidence except Bahar to SMD, whereas out of thirteen IVT early duration entries, only one entry RKPV405-10 showed resistant reaction but others were susceptible to SMD and the disease incidence ranged from 68 per cent to 100 per cent. Out of 61 Hyderabad, ICPL99095 and ICP7035 showed resistant reaction and ICPL20123 showed moderately resistant reaction and rest of the entries were showed susceptible reaction.

Key words: *Pigeonpea, Sterility Mosaic Disease (SMD), Screening, Leaf stappling and Pieonpea sterility mosaic virus*

INTRODUCTION

Pulses are legumes and rich source of protein to most of the world's marginal and vegetarian population. It helps to supplement dietary requirements, improve nutritional quality, food security and environmental sustainability. It plays an important role in food and nutritional security because it is a rich source of proteins, minerals and vitamins. In India, pigeonpea is cultivated in an area of about 36.3 lakh ha with an annual production of 27.6 lakh tones averaging a productivity of 760.33 kg ha. The biotic stresses are considered as one of the main reasons for limiting the yields in pigeonpea.

Among them the major biotic stresses causing economic concerns in yield are the Fusarium wilt, Sterility Mosaic Disease (SMD) and Phytopthora Blight. SMD is one among the most destructive disease of pigeonpea causing yield losses up to 95 per cent Presently disease is very severe in major pigeonpea growing regions of Karnataka. SMD is caused by PPSMV and it is transmitted by an eriophyid mite, *Aceria cajani.*

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There are five major isolates which causes SMD, among them Patancheru, Bangalore and Coimbatore isolates are well studied

The task of developing resistant varieties is complicated in view of the genetic plasticity of the pathogen. Despite several attempts especially during the past 20 years, the agents of SMD remain uncharacterized and posed a big challenge to the scientific community. Effective method of managing virus diseases of crop plants is by using resistant varieties which is most economical, inexpensive and eco friendly for resource poor farmers in comparison to chemicals. The cost of cultivation with disease/pest resistant varieties was found to be less in comparison to other methods

MATERIAL AND METHODS

Pigeonpea genotypes obtained from ICRISAT and AICRP centers were evaluated under field condition during kharif 2015 for resistance to PPSMV at ZARS, GKVK, UAS, Bengaluru, to identify the resistant source. Pigeonpea germplasm includes State and central released varieties, Hyderabadmaterial, materials generated and maintained at AICRP on Pigeonpea. During *Kharif* 2015, 112 genotypes were screened against SMD and presented here.

Leaf stapling technique

The method described by Nene *et al.*[5] was adopted. Leaflets infected with Sterility Mosaic Disease (SMD) carrying sufficient number of mites were taken and stapled onto the young leaves of each test plants of different genotypes of pigeonpea. One diseased leaflet per primary leaf was stapled. The diseased leaves collected from the infected plant were observed under binocular microscope for the presence of eriophyid mite. The diseased leaflets were folded on the primary leaf in such a way that its lower surface came in contact with the primary leaf of the seedling. It was then stapled with a small paper stapler. In case of small diseased leave, two leaves were placed alternatively in such a way that the lower surface of the diseased leaf come in contact with both the surfaces of the leaflet of test plant. The leaves were stapled with diseased leaflet at the age of 10-15 days of seedling. The advantages of this method were that it facilitated inoculation at the primary leaf stage, and disease symptoms were rapidly ex-pressed[5]. The technique is very useful in confirming resistance of the lines observed as promising under field conditions, and for disease inheritance and strain identification studies.

As the stapled leaflets from the infected plants get dried, mites from the infected leaf migrate to healthy leaf and inoculate the virus. After transmission of virus from the infected plants to healthy seedlings, seedlings were scored for SMD incidence at 15 days interval up to 75 days by counting the healthy plants (no mosaic symptoms) and diseased plants (with mosaic symptoms) as per the criterion followed in All India Co-ordinated Research Project (AICRP) on pigeonpea.

Plants were regularly monitored for the symptom expression at 15 days interval and PDI is calculated to categorize the genotypes into different disease reactions.

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

AICRP scale was adopted to evaluate the genotypes against SMD and categorize the genotypes into different disease reactions

Disease incidence (per cent)	**Reaction**
0.0– 10.00	: Resistant
10.10– 30.00	: Moderately resistant
>30.00	: Susceptible

RESULT AND DISCUSSION

Reaction of Advanced Varietal Trial (AVT) entries against sterility mosaic disease

Ten advanced varietal trial entries tested against SMD. None of the entries showed resistant reaction or moderately resistant reaction to SMD. All AVT entries showed susceptible reaction to SMD. Their disease incidence varied from 82 to 100%. Only one entry Bahar which was grown as resistant check, which showed resistant reaction but remaining were susceptible to SMD. The results are presented in Table 1.

Reaction of Initial Varietal Trials (IVT) Medium duration entries against sterility mosaic disease

Twenty two pigeonpea IVT medium duration entries tested against SMD. Out of 22 entries, none of the entries showed resistant reaction but all were showed more than 50 per cent disease incidence except Bahar to SMD.The results are presented in Table 2.

Reaction of Initial Varietal Trial (IVT) medium early duration entries to against sterility mosaic disease

Fifteen IVT medium early entries tested against SMD. None of the entries showed resistant reaction or moderately resistant reaction to SMD. All IVT medium early entries showed susceptible reaction to SMD. Out of fifteen entries, none of the entries showed resistant reaction but all were showed more than 50 per cent disease incidence.The results are presented in Table 3.

Reaction of Initial Varietal Trials (IVT) Early duration entries against sterility mosaic disease

Thirteen pigeonpea IVT early duration entries tested against SMD. Out of thirteen entries, only one entry RKPV405-10 showed resistant reaction but others were susceptible to SMD and the disease incidence ranged from 68 per cent to 100 per cent.The results are presented in Table 4.

Screening of ICRISAT germplasm against sterility mosaic disease

Out of 61 Hyderabad accessions tested against SMD during *Kharif* 2015, ICPL99095 and ICP7035 showed resistant reaction and ICPL20123 showed moderately resistant reaction and rest of the entries were showed susceptible reaction. The results are presented in Table 5.

The results are in agreement with the earlier research findings, Saifulla *et al*. they screened the four pigeonpea genotypes *viz*., BRG 3, ICP 7035, Hy-3C and ICP 8863 against SMD for three consecutive years from 2002-03 to 2005-06. BRG 3 and ICP 7035 recorded resistant reaction, while the genotype

Rangaswamy *et al*.,[7] found that ICPL-7035 entry was resistant to SMD. Similarly Barhate *et al*., [2] also observed that ICPL-9174 was resistant to SMD after screening a pigeonpea mini core collection, reported that eleven entries *viz*., ICPs 3576, 7869, 9045, 11015, 11059, 11230, 11281, 11910, 14819, 14976 and15049 had sterility mosaic disease resistance . Jaggal, *et al.,*[4] noticed that 92 accessions were found resistant to sterility mosaic disease.

Several researchers[1, 7, 8, 10, 9, 3,11] have also reported identification of SMD resistant genotypes from different kinds of mapping populations in pigeonpea. In the present study, 188 RILs showed digenic ratio (9S:7R) for SMD resistance, indicating complementary gene action which showed dominance of susceptibility over resistant and based on the per cent disease incidence, the RILs could be broadly classified as resistant (PDI <20%) and susceptible (PDI >20%).

Table 1. Screening of pigeonpea genotypes against PPSMV

Table 1. Reaction of Advance varietal trial (AVT) entries to SMD during 2015-16			
Sl no	**Genotypes**	**PDI**	**Reaction type**
1	AKTM 10-12	100	**S**
2	CO 6	100	**S**
3	GJP 1304	82.50	**S**
4	KDPV 1995	100	**S**
5	LRG 151	100	**S**
6	NTL 740	85.90	**S**
7	RVKT 297	97.22	**S**
8	TDRG 107	100	**S**
9	Bahar (**R-CHECK**)	0	**R**
10	ICP 8863 (S-CHECK)	100	**S**

Table 2. Reaction of Initial varietal trial (IVT) medium duration entries to SMD during 2015-16			
Sl. no	**Genotypes**	**PDI**	**Reaction type**
1	AKTE 12-02	92.5	**S**
2	BDN 2008-7	100	**S**
3	BRG 15-1	33.3	**S**

4	BRG 15-2	48.8	**S**
5	BSMR 243	88.3	**S**
6	CRG 2008-1	100	**S**
7	CRG 2012-25	100	**S**
8	CRG 2O13-30	100	**S**
9	GJP 1401	100	**S**
10	GJP 1406	95.8	**S**
11	GRG 242-2-5	100	**S**
12	GRG 2013	100	**S**
13	LRG 117	100	**S**
14	LRG 170	90	**S**
15	RPS 2007-10	100	**S**
16	TDRG 107	100	**S**
17	TRG 59	100	**S**
18	WRGE 242	97.8	**S**
19	WRGE 252	100	**S**
20	ICP 8863 (S-check)	100	**S**
21	ICP 7035 /Bahar(R-check)	0	**R**
22	ICP 2376 (S-check)	100	**S**
23	CO 6 (Scheck)	100	**S**

Table 3. Reaction of IVT Initial varietal trial (IVT) Medium Early entries to SMD during 2015-16

Sl. no	Genotypes	PDI	Reaction type
1	AH 12-09	100	**S**
2	AH 12-11	100	**S**
3	BRG 15-3	90	**S**
4	BRG 15-4	44.81	**S**
5	LRG 160	100	**S**
6	NTL 130	100	**S**
7	PT 07065-3-1-1	100	**S**
8	PT 04 -378	100	**S**
9	RKPV 310-07	100	**S**
10	RKPV 449-02	90.23	**S**
11	WRGE 90	100	**S**
12	WRGE 92	90.90	**S**
13	BRG 3 (R-CHECK)	0	**R**
14	ICP 8863 (S-check)	100	**S**
15	ICP 2376 (S-check)	100	**S**

Table 4. Reaction of Initial varietal trial (IVT) Early duration entries to SMD during 2015-16

Sl. no	Genotypes	PDI	Reaction type
1	AL 2025	100	**S**
2	AL 2046	68.18	**S**
3	CRG 2012-20	98.88	**S**
4	CORG 9701	100	**S**
5	ICP 2376	100	**S**
6	PA 443	80.94	**S**
7	RKPV 405-10	20.78	**R**
8	RKPV 3010-03	95.95	**S**
9	SJP 102	100	**S**
10	SJP 702	100	**S**
11	VBN 3	100	**S**
12	ICP 8863 (Scheck)	100	**S**
13	ICP 7035/ Bahar (Rcheck)	0	**R**

Table 5. Reaction of ICRISAT entries to SMD during 2015-16

Sl. no	Genotypes	PDI	Reaction type
1	ICP 11376	100	**S**
2	ICP 12012	100	**S**
3	ICP 12728	47.5	**S**
4	ICP 12739	91.7	**S**
5	ICP 12752	19.6	**S**
6	ICP 13361	66.7	**S**
7	ICPL 94062	83.3	**S**
8	ICPL 20095	100	**S**
9	ICPL 20119	75	**S**

10	ICPL 20123	22.2	**MR**
11	ICPL 20124	80	**S**
12	ICPL 20135	100	**S**
13	ICPL 20136	100	**S**
14	ICPL 90011	45.3	**S**
15	ICPL 96053	83.3	**S**
16	ICPL 96061	100	**S**
17	ICPL 99008	92.9	**S**
18	ICPL 99009	78.3	**S**
19	ICPL 99044	100	**S**
20	ICPL 99048	100	**S**
21	ICPL 99055	100	**S**
22	ICPL 99091	90	**S**
23	ICPL 99095	5.9	**R**
24	ICPL 99098	90	**S**
25	ICPL 99099	25.7	**S**
26	ICPL 99100	83.3	**S**
27	ICP 2376	100	**S**
28	ICP 8863	100	**S**
29	ICP 7035	0	**R**

PDI: Per cent disease index, R check: Resistant check, **R**-Resistant, **MR**: Moderately resistant, **S**: susceptible and **S check**: Susceptible check

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