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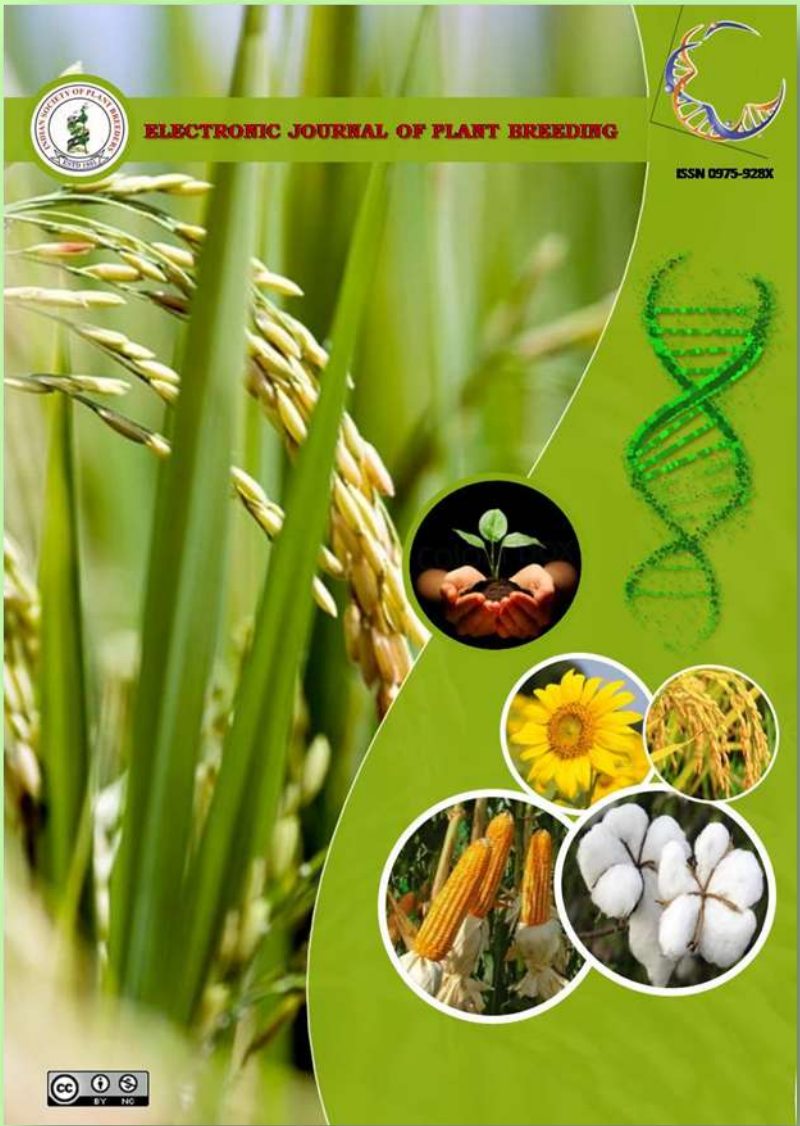

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Research Article

Evaluation of pigeonpea (*Cajanus cajan)* genotypes against pigeonpea sterility mosaic disease

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Abstract
Pigeonpea (*Cajanus cajan)* is a drought-resistant pulse crop cultivated in the semi-arid regions of the world. Sterility mosaic disease (SMD) also known as "green plague of pigeonpea" is one of the severe threats in pigeonpea production causing severe yield loss. To overcome this issue, breeding for resistant varieties is considered to be one of the most effective and economic methods of reducing the crop losses and has received the top priority. Ninety four genotypes including checks were screened for SMD resistance by adopting leaf stapling technique at glass house condition. Based on the percent disease incidence (PDI), the genotypes could be classified as highly resistant (0%) and highly susceptible (100%). out of ninety four genotypes screened , four genotypes i.e., DPP 2-89, DPP 3-182, IC 22557 and ICP 3666 showed highly resistant reaction to SMD infection while fifty four genotypes were highly susceptible. Therefore, these four genotypes may be utilized for SMD resistance breeding programme.

Introduction

Pigeonpea (*Cajanus cajan*) is one of the most important pulse crops of semi-arid tropics and subtropics regions *viz*., Asia and Africa (Van Der Maesen, 1990). Pigeonpea also popularly known as redgram, tur or arharand is primarily grown for its protein source particularly in the developing countries like India, where majority of the population depends on low priced vegetarian foods for meeting their dietary requirements. Pigeonpea seed contains rich source of essential amino acids, carbohydrates, minerals and high amounts of vitamin A and C (Faris, 1987) and is the principal source of dietary protein (20 to 30 %) for an estimated population of 1.1 billion. It is grown as a sole crop or as an intercrop with cereals (maize, sorghum, pearl millet, finger millet), fibre and other legume crops (groundnut, soybean) under wide climatic conditions and rainfed low- input agricultural systems (Nene and Sheila, 1990). India stands first in both area and production of pigeonpea among the countries. However, its productivity is lower than the world average, which may be attributed to various abiotic and biotic constraints.

The major biotic stresses are Sterility Mosaic Disease(SMD) and Fusarium wilt which causes severe economic yield loss. Sterility Mosaic Disease is one among the most destructive diseases. The causal agent of the disease is Pigeonpea Sterility Mosaic Virus and is transmitted by the vector, Eriophyid mite (*Aceria cajani*).The symptom of SMD includes bushy and pale green leaves, excess vegetative growth, leaf size reduction, mosaic and mottling of leaves and cessation of reproductive structures. The disease also described as the green plague because at flowering time, affected plants remain green with more vegetative growth and have no flower, and spread rapidly like a plague, leading to severe epidemics. The infected plants fail to produce flowers and therefore no pod set occurs causing severe yield loss. Even though control of disease by chemicals is effective but it is not economically viable and non eco-friendly (Nene *et al.,* 1990). Breeding for SMD resistant pigeonpea genotype is regarded as one of the most effective and economic methods to increase the yield. Hence, the present study was aimed at identifying genotype with stable and broad based resistant to SMD.

Materials and Methods

The present investigation on intensive screening of pigeonpea genotypes against sterility mosaic disease was carried out during *Kharif* 2018 under Glass house condition in Department of Pulses, Tamil Nadu Agricultural University, Coimbatore. Ninety four pigeonpea germplasm was evaluated for sterility mosaic disease screening. The susceptible pigeonpea variety, ICP 8863(Maruthi) was used as inoculum which is maintained in the Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore. Leaf stapling technique (Nene and Reddy 1976a)was adopted to transmit the disease. The SMD infected leaf samples were collected and observed under binocular microscope for the presence of Eriophyid mites (*Aceria cajani*), which transmits the SMD causing virus. Then, the leaf samples were stapled in the primary leaves of genotypes to be screened. Plants were scored for SMD incidence at 15 days interval from day after the first inoculation up to 90 days by observing the disease symptom. Based on the disease development the PDI was calculated and the

$$\text{PDI (Percemt Disease Incidence} = \frac{\text{Number of plants infected}}{\text{Total number of plants observed}} \times 100$$

Rating scale	Disease incidence (per cent)	Type of symptom
1	0	No symptom on any plant
3	0.1- 20.0	Symptom on fewer plants
5	20.1-50.0	Ring spot / Mild mosaic symptom on most plants, causing partial sterility
7	50.1 or more	Severe mosaic on most plants, almost complete sterility

Based on the disease reaction, genotypes were categorized as resistant, moderately resistant, susceptible and highly susceptible.

Results and Discussion

Among ninety four genotypes screened for their resistance to SMD five genotypes *viz.,* DPP 2-89, DPP 3-182, IC 22557, ICP 3666 and ICP 13264 showed highly resistant reaction with 0% PDI and three genotypes *viz.,*IC 525411 (8%), ICP 12327 (5%) and ICP 14040 (5%) were found to be resistant genotypes. The genotypes *viz.,* ICPL 11023, IC 525413, IC 525424, ICP 12467, ICP 12527, C2542, ICP 3359, ICP 10242, ICP 10760, IC 332216 and CO 8 were identified as moderately resistant with the range of 12 – 25 per cent disease incidence and twenty one genotypes showed susceptible reaction with the range from 34.67 - 50 per cent disease incidence. Fifty three genotypes showed highly susceptible reaction with range from 52 -100 per cent disease incidence. The results are presented in the Table 1. By using the leaf stapling technique Prabhavathi and Ramappa (2018) reported that out of sixty one genotypes, ICPL 99095 and ICP 7035 showed resistant reaction and ICPL 20123 showed moderately resistant reaction and remaining entries showed susceptible reaction. Joshi *et al.* (2017)found that thirty three RILs were identified as resistant lines which consistently showed 0% PDI during screening. On Screening of 60 entries, only eight entries *viz.,*ICPL-87119,ICPL-2376,BDN-2,PT-4-307,CORG-9701,BSMR-736,GRG-811and BSMR-853 were found resistant to be sterility mosaic disease, as reported by Vijaya Bhaskar (2016).Similarly eighteen genotypes were found to be highly resistant against sterility mosaic which has been reported by Kaushik *et al.* (2013). Among 146 accessions six accessions and 24 accessions showed resistant reaction to Fusarium Wilt and SMD, respectively. Combined resistance to Fusarium wilt and SMD was found in five accessions, ICP 6739, ICP 8860, ICP 11015, ICP 13304 and ICP 14819 as been reported by Sharma *et al.* (2012).Manjunatha *et al.* (2013)evaluated pigeonpea genotypes against SMD during 2010-11 and 2011-12 by leaf stapling technique and found that seven entries *viz.*, ICP 7035, BRG 3, ICPL 87091, IPA 8F, IPA 15-F, GT 101 and JKM 189 were resistant. Similar result has been reported by Pallavi (2014) using leaf stapling technique to screen the pigeonpea genotypes against sterility mosaic disease and found that five genotypes *viz.*, ICP 7035, GAUT- 001, BAHAR, BRG-3, and IPA 8F showed resistance, eight genotypes showed moderately resistance and 261 genotypes showed susceptible reaction. Jaggal *et al.* (2014)reported that out of 135 Pigeonpea accessions evaluated for FW and SMD,24 accessions were found to be resistant for both FW and SMD under field condition.

The biometrical characters were tabulated for highly resistant, resistant and moderately resistant lines in Table 2. The highest mean performance for pod weight per plant and single plant yield was recorded in IC 525413 with the value of 185.67g and 99.13 g, respectively, whereas CO 8 (4.45 and 376.25) recorded highest mean value for number of seeds per pod and number of pods per plant, respectively. Genotype IC 332216 (13.07) recorded high mean value for hundred seed weight. The highest mean performance for Shelling percentage was exhibited by ICP 3359 (84.12 %).

Based on the screening and yield performance data the genotype IC 525413 showed moderately resistant reaction to SMD with high single plant yield. Hence, this genotype may be used as parent for SMD resistant breeding programme. Highly resistant lines with low yield performance may also be used as donor parent for introgression of resistance to high yielding varieties.

References

Faris, D. (1987). Vegetable pigeonpea: a promising crop for India.

Jaggal, L., Patil, B., and Salimath, P. (2014). Evaluation of mini core accessions of pigeonpea (*Cajanus cajan* (L.) Millsp.) against sterility mosaic disease and fusarium wilt. *Karnataka J.Agric. Sci,* **27**(3), 337-339.

Joshi, S., Revath, T., Umadevi, G., Sameer Kumar, C., and Anuradha, G. (2017). Study of Sterility Mosaic Disease Resistance on Immortal Population in Pigeonpea. *Int.J. Curr.Microbiol.App. Sci,* **6(**9), 1-6.

DOI: 10.5958/0975-928X.2019.00094.2

Kaushik, D., Srivastava, S., Singh, J. P., Chauhan, V., and Singh, R. (2013). Evaluation of pigeonpea genotypes against Sterility Mosaic Disease (SMD) caused by the mite vector, *Aceria cajani. J. Mycopathol. Res,* **51**(2), 225-233.

Manjunatha, L., Ramappa, H., Gowda, M., and Rangaswamy, K. (2013). Prevalence of sterility mosaic disease in Karnataka and its resistance source. *Mysore J. Agric. Sci,* **47(**2), 314-319.

Nene, and Reddy. (1976a). A new technique to screen pigeon pea for resistance to sterility mosaic. *Tropical Grain Legume Bulletin, 5*, 23.

Nene, and Sheila. (1990). Pigeonpea: Geography and importance. 1-14.

Pallavi, M. (2014). Epidemiology and Molecular Identification of Pigeonpea Sterility Mosaic Virus (PPSMV).*Univ. Agric. Sci*, GKVK.

Prabhavathi, N., and Ramappa, H. (2018). Field evaluation of Pigeonpea Genotypes against Pigeonpea sterility mosaic virus (PPSMV). *Int. J. Pure App. Biosci,* **6**(5), 57-61.

Sharma, M., Rathore, A., Mangala, U. N., Ghosh, R., Sharma, S., Upadhyay, H., and Pande, S. (2012). New sources of resistance to Fusarium wilt and sterility mosaic disease in a mini-core collection of pigeonpea germplasm. *Eur. J. Plant Pathol,* **133**(3), 707-714.

Van Der Maesen, L. (1990). Pigeonpea: origin, history, evolution, and taxonomy. *The pigeonpea.*, 15-46.

Vijaya Bhaskar, A. (2016). Screening of pigeonpea genotypes against wilt and sterility mosaic disease in Telangana state, India. *Indian J. Agric. Res,* **50**(2).

Table 1. Incidence of sterility mosaic disease on different genotypes

Germplasm	PDI	Reaction type	Germplasm	PDI	Reaction type
ICP 13264	0	HR	IC 525471	60	S
DPP 2-89	0	HR	ICP 3314	60	S
DPP 3-182	0	HR	ICP 11337	60	HS
IC 22557	0	HR	ICP 12541	62.5	HS
ICP 3666	0	HR	IC 33744	62.5	HS
ICP 12327	5	R	ICP 9808	62.5	HS
ICP 14040	5	R	ICP 11124	62.5	HS
IC 525411	8	R	ICP 11675	62.5	HS
IC 525413	12	MR	IC 525434	64	HS
ICP 10242	12.5	MR	IC 525472	64	HS
ICP 10760	12.5	MR	IC 525483	64	HS
ICPL 11023	13.33	MR	IC 525553	64	HS
IC 332216	16.67	MR	ICP 525406	64	HS
IC 525424	18	MR	ICP 12226	64	HS
ICP 12467	20	MR	ICP 7160	65	HS
CO 8	20	MR	ICP 10930	65	HS
ICP 12527	25	MR	ICP 7660	66.67	HS
C 2542	25	MR	IC 525432	68	HS
ICP 3359	25	MR	IC 525443	68	HS
IC 525426	34.67	S	IC 9066	68	HS
IC 338829	35	S	ICP 2913	68.75	HS
ICP 7841	37.5	S	ICP 3811	68.75	HS
IC 338943	37.5	S	IC 525531	72	HS
IC 525473	40	S	ICP 525405	72	HS
ICP 8030	40	S	ICP 91	75	HS
IC 338933	40	S	ICP 7353	75	HS
IC 525475	42	S	ICP 12057	76	HS
ICP 7705	43.75	S	IC 525500	76	HS
ICP 7824	43.75	S	IC 525536	76	HS
IC 525457	44	S	IC 525467	76	HS
IC 525463	44	S	ICP 12280	76	HS
IC 525407	44	S	ICP 12321-2	76	HS
ICP 14021	45	S	ICP 274	77.08	HS
ICP 11003	45.83	S	IC 525466	80	HS
ICP 1135	47.5	S	IC 525456	84	HS
ICP 1604	50	S	IC 525494	84	HS
ICP 7853	50	S	ICP 9224	84	HS
ICP 8819	50	S	IC 525436	84	HS
ICP 8113	50	S	IC 525521	84	HS
ICP 12712	50	S	IC 339044	85	HS
IC 336775	50	S	IC 42247	87.5	HS
IC 525410	52	HS	IC 24148	87.5	HS
ICP 4519	54.17	HS	ICP 7767	87.5	HS
IC 525464	56	HS	ICP 10967	88	HS
ICP 3215	56.25	HS	IC 525403	92	HS
ICP 5130	56.25	HS	IC 12050	92	HS
ICP 14282	59	HS	Maruthi	100	HS

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Table 2.Biometrical traitof pigeonpea sterility mosaic disease resistant lines (highly resistant,resistant and moderately resistant)

GERMPLASM	PWPP	NSPP	NPPP	HSW	SPY	SP
DPP 2-89	32.00	4.40	161.00	11.08	24.83	77.59
DPP 3-182	75.00	4.00	238.33	10.65	36.93	49.24
IC 22557	44.33	3.67	321.00	11.30	20.90	47.15
ICP 3666	74.67	4.20	266.00	10.14	35.80	47.94
ICP 13264	60.67	4.00	167.00	10.30	38.57	63.57
IC 525411	52.67	4.00	254.00	10.57	30.97	58.80
ICP 12327	40.67	3.80	193.67	9.20	32.73	80.48
ICP 14040	67.00	3.67	224.33	10.06	36.60	54.63
ICPL 11023	74.67	4.20	248.67	11.60	24.47	32.77
IC 525413	185.67	4.20	356.00	11.06	99.13	53.39
IC 525424	146.00	4.40	415.00	12.52	90.40	61.92
ICP 12467	131.33	4.00	367.67	11.05	50.97	38.81
ICP 12527	93.67	4.40	233.33	10.40	40.90	43.66
C 2542	76.67	4.00	225.33	11.60	39.83	51.95
ICP 3359	71.33	4.00	259.33	11.06	60.00	84.12
ICP 10242	42.00	3.67	196.67	10.85	22.23	52.93
ICP 10760	73.33	4.00	255.00	12.56	32.47	44.28
IC 332216	86.33	4.40	278.00	13.07	44.10	51.08
CO8	84.25	4.45	376.25	12.79	39.75	49.14
Mean	**79.59**	**4.08**	**265.08**	**11.15**	**42.19**	**54.92**

PWPP - Pod weight per plant (g), **NSPP** - Number of seeds per pod, **NPPP -** Number of pods per plant, **HSW -** Hundred Seed weight (g), **SPY -** Single Plant yield(g), **SP -** Shelling percentage