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Evaluation of Pigeonpea Genotypes against Sterility Mosaic Disease

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Authors' contributions

This work was carried out in collaboration among all authors. 'All authors read and approved the final manuscript.

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ABSTRACT

Pigeonpea (*Cajanus cajan* L.) belonging to family Leguminosae is an important leguminous pulse crop of semi-arid tropic and subtropic regions (Asia and Africa). It is also known as red gram, arhar, tur dal. The crop is affected by several phytopathogens, of which, pigeonpea sterility mosaic disease/virus, and transmissible by eriophyid mites (*Aceria cajani*) has been a major bottleneck. Yield losses up to 95 per cent or even 100 per cent in severe Sterility Mosaic Disease incidence were reported. Therefore, present investigation on screening of pigeon pea genotypes against the sterility mosaic disease was carried out during Kharif, 2018 at the Department of Plant Pathology, College of Agriculture, Latur.

In present study, about 27 entries of pigeonpea were screened under natural epiphytotic against pigeonpea sterility mosaic disease. Of these GRG-152, ICP-2376, BRG-5, BRG-4, ICPL-15048, BSMR853, BSMR-736, BRG-1and BRG-3 were resistant; MPV-106, RVSA-16-1, IPA-16-8 and BRG-2 were moderately resistant, whereas, PUSA-2017-01, TDRG-58, ICP-8863, PUSA-2018, PUSA-2018-1, PUSA-2018-2, PUSA-2018-3 ,PUSA-2018-5, AKTE-12-04, KRG-244, PADT-16, RKPV-912, JKM-189 and TJT-501 were susceptible to Sterility Mosaic disease.

Keywords: Sterility mosaic of disease; pigeonpea; screening; genotypes.

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1. INTRODUCTION

"Pigeonpea (*Cajanus cajan*L.) is an important pulse crop of semi-arid tropic and subtropic regions *viz.,* Asia and Africa. Pigeonpea is grown in India over an area of 5.39 M ha with an annual production of 4.60 M tones and productivity of 854 kg/ha, whereas, in Maharashtra these were 1037.0 ha, 661.0 tones and 637 kg/ha, respectively" [1].

"Pigeonpea crop being affected by around 50 diseases/pathogens, in mild to severe form. Of these, Sterility Mosaic Disease (SMD) caused by Pigeonpea Sterility Mosaic Virus (PPSMV) is a widespread and economically important disease. It is transmitted by the eriophyid mite (*Aceria cajani).* Sterility Mosaic Disease (SMD), was first described in 1931 from Pusa, Bihar State of India, is a major disease limiting the pigeonpea production in the Indian sub-continent". [2] "SMD causes substantial yield losses up to 95 per cent" [3]. "The vector, eriophyid mite, is host specific with a narrow host range confined to pigeonpea and few of its wild relatives" [4]. "It is the sole vector responsible for the transmission of SMD in pigeonpea" [5,6].

PSMD is the most destructive disease of pigeonpea [7] causing yield losses up to 95 percent [3,8]. The early stage (<45-days old plants) of infection results into 95 to 100 percent yield losses as reported by Reddy et al. [9]; Kulkarni et al. [5]. The disease results in 100 percent yield loss when symptoms appear at the pre-flowering and podding stage. Whereas, at maturity stage loss could be of 67 percent and at pre-harvest stage up to 30 percent.

"Manifestation of PSMD chiefly depends on the availability of mite populations" [10]. During recent years, research programs have focused on the development of high yielding genotypes with combined resistance to PPSMV and *Fusarium* wilt, as both these diseases are endemic in the subcontinent. Therefore, the present study was carried out with aimed to screen the pigeonpea genotypes against sterility mosaic disease to identify the resistant sources.

2. MATERIALS AND METHODS

A field experiment was conducted in the research farm at the Department of Plant Pathology, College of Agriculture, Latur during *Kharif* 2018-19. All twenty-seven pigeonpea germplasms, cultivars and varieties obtained from different sources were evaluated for their reactions against pigeonpea sterility mosaic disease (SMD). These genotypes were planted in each row with row to row spacing of 60 cm and plant to plant spacing of 15 cm SMD susceptible check (variety Maruthi) was included after every 10 test rows. The symptoms showing sterility mosaic were recorded and disease incidence were recorded. Based on disease reactions to sterility mosaic, pigeonpea germplasms were categorized as given below, by applying the rating scale of All India Coordinated Research Project on Pigeonpea.

Based on symptoms of sterility mosaic disease in field disease incidence was recorded. Per cent disease incidence (PDI) was calculated by using following formula:

PDI = (Number of diseased plants/ Total number of plants observed) ×100

3. RESULTS AND DISCUSSION

Twenty-seven pigeonpea elite entries were screened against sterility mosaic disease (SMD) under field conditions, at the research farm Department of Plant Pathology, College of Agriculture, Latur. Average per cent incidence of SMD was calculated and accordingly the test entries were categorized.

The symptoms of sterility mosaic of pigeonpea observed during screening were bushy and pale green appearance of plants followed by reduction in size, increase in number of secondary branches and mosaic mottling of leaves and finally partial or complete cessation of reproductive structures. In some plants affected plants remain green with more vegetative growth and have no flower or seed pods (Fig.1 and 2a and b). The result (Table 1) revealed zero disease incidence in ICP-2376, BRG-4, BRG-5, BSMR-853, BRG-1 and BRG-3, followed by ICPL-15048 (2.22%) and BSMR-736 (2.94%). Whereas, highest disease incidence (100%) was reported in ICP-8863, PUSA-2018 and AKTE-12-04, followed by PUSA-2018-2 (97.56%) and PUSA-2018-1 (86.84%).

Table 1. Pigeonpea sterility Mosaic disease rating scale

Sr. No.	Disease incidence	Reactions
1	0-10%	Resistant
2	11-30%	Moderately Resistant
3	>30%	Susceptible

Based on per cent SMD incidence, the test pigeonpea entries were categorized, which revealed the entries *viz.,* GRG-152, ICP-2376, BRG-4, BRG-5, ICPL-15048, BSMR-853, BSMR-736, BRG-1 and BRG-3 as resistant with the SMD incidence in the range of 0-10 per cent. The entries *viz.,* MPV-106, RVSA-16-1, IPA-16-18 and BRG-2 were moderately resistant (11-30% incidence) and the entries *viz.,* PUSA-2017-01, TDRG-58, ICP-8863, PUSA-2018, PUSA-2018-1, PUSA-2018-2, PUSA-2018-3, PUSA-2018-5, AKTE-12-04, KRG-244, PADT-16, RKPV-912, JKM-189, TJT-501 were susceptible (> 30% incidence).

These results on the reactions of pigeonpea entries against SMD are reported on similar line to the reports of several earlier workers such as Manjunatha et al. [11], Barhate et al. [12], Bhaskar [13], Sudharani et al. [14] and Roy and Kumar (2018), Tharageshwari et al. [16] Dhanushasree et al. [17]. Manjunatha et al. [15] reported BRG-3 as resistant to SMD with high seed yield, BRG-2 as moderately resistant and ICP-8863 as susceptible. Barhate et al. [12] reported 100 per cent incidence (100%) of sterility mosaic in cv. ICP-8863. Bhaskar (2016) reported BSMR-736 and BSMR-853 as resistant to sterility mosaic, BRG-2 as moderately resistant and ICP-8863 as susceptible to sterility mosaic disease. Sudharani et al. [14] reported cv.GRG-152 as moderately resistant to SMD, Roy and Kumar [15] reported PADT-16, ICP-8863, TDRG-58 and JKM-189 as susceptible to sterility mosaic disease. According to Tharageshwari et al. [16], out of the ninety-four genotypes studied, only four genotypes, DPP 2-89, DPP 3-182, IC 22557, and ICP 3666 showed highly resistant reaction to SMD infection, whereas fifty-four genotypes showed highly sensitive reaction. Genotypes viz., CRG 16-07, BWR 153, ICP 7919, IC 339057, IC74016, IPAE 15-05, AL 2250, CRG 16-01, Pusa Arhar 21-14, Pusa Arhar 21-27, BWR 253, ICP 9808 and ICP 7234 were found to be SMD resistant ones and can be utilized as donors for resistant breeding program to reduce yield loss as compared to susceptible types [18].

Infected sterile plant **Healthy Plant**

Fig. 1. Comparison between healthy plant and infected plant

Fig. 2a. Various stages of sterility mosaic symptoms development

Increase in secondary and tertiary branches

Bushy and pale green appearance

Mosaic pattern of leaves

Mottling of leaves

Fig. 2b. Symptoms produced in experimental field

Table 2. Screening of pigeonpea genotypes against *Pigeonpea Sterility Mosaic Virus* disease

Sr. No.	Entries	Total plants	SMD plants	% Disease Incidence	Disease Reactions
1.	GRG-152	44	4	9.09	R
2.	MPV-106	43	12	27.90	MR
3.	PUSA- 2017-01	48	29	60.41	S
4.	RVSA-16-1	38	11	28.94	MR
5.	TDRG-58	39	17	43.58	S
6.	ICP-8863 (S. Check)	44	44	100	S
7.	PUSA-2018	37	37	100	S
8.	PUSA-2018-1	38	33	86.84	S

Sr. No.	Entries	Total plants	SMD plants	% Disease Incidence	Disease Reactions
9.	PUSA-2018-2	41	40	97.56	S
10.	PUSA-2018-3	35	25	71.42	S
11	PUSA-2018-5	31	19	61.29	S
12	ICP-2376	42	0	0	R
13.	AKTE-12-04	32	32	100	S
14.	IPA-16-18	30	5	16.66	MR
15.	KRG-244	29	19	65.51	S
16.	PADT-16	30	19	63.33	S
17.	RKPV-912	32	14	43.75	S
18.	BRG-2	38	11	28.94	MR
19.	BRG-4	33	0	0	R
20.	BRG-5	37	0	0	R
21.	ICPL-15048	45	1	2.22	R
22.	JKM-189	39	12	30.76	S
23.	TJT-501	33	17	51.51	S
24.	BSMR-853	41	0	0	R
25.	BSMR-736	34	1	2.94	R
26.	BRG-1	36	0	0	R
27.	BRG-3	43	0	0	R

SMD: Sterility mosaic diseased R: Resistant MR: Moderately Resistant S: Susceptible

Conventional plant breeding methods have been effective in bringing about improvement in crops but efforts are still being made to develop more efficient breeding methods to overcome specific problems.

4. CONCLUSION

These results on the reactions of pigeonpea entries against SMD are nine genotypes are resistant, four are moderately resistant and fourteen were susceptible to the pigeonpea sterility mosaic disease.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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