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Screening of pigeonpea genotypes through different screenig techniques against sterility mosaic disease

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The experimental material consisted of 82 pigeonpea genotypes of medium to long duration. Out of 82 genotypes, 22 genotypes were screened for sterility mosaic by using Leaf stapling technique and petiole grafting technique in pots. In field, 82 genotypes were screened by using Infector hedge technique as well as Leaf stapling technique. All the 22 genotypes except TT 701 and SM 03-17 exhibited symptom of sterility mosaic disease when inoculated adopting both leaf stapling and petiole grafting techniques. Out of 82 genotypes tested against sterility mosaic, sixteen were free from disease and grouped as highly resistant , fourteen genotypes were resistant showing 0.1 to 10 per cent disease incidence, while twenty seven genotypes were moderately resistant showing 10.1 to 25 per cent incidence of disease. Rests of the genotypes were susceptible to highly susceptible showing 25.1 to 100 per cent of disease incidence.

Key words: Pigeonpea, Sterility mosaic disease, Petiole grafting technique, Leaf stapling

INTRODUCTION

Sterility mosaic disease (SMD) is the most damaging disease of pigeonpea (*Cajanus cajan* (L.) Millsp.) in Indian subcontinent and known to occur in major pigeonpea growing areas of India, (Kulkarni *et al.*, 2002). The disease is some time referred to as the "Green plague" because at flowering times, affected plants are green with excessive vegetative growth and have no flower or pod; under congenial conditions. It spreads rapidly like a plague, leading to severe epidemics (Kulkarni *et al*., 2004).The disease is characterized by proliferation, mosaic symptoms, cessation of reproductive growth and a reduction in the size of the leaflets (Kandaswamy and Ramakrishnan, 1960). The pathogen causing the disease was reported to be a virus (Capoor, 1952), transmitted by eriophyde mite, *Aceria cajani*, (Seth, 1962).Several lines resistant or tolerant to the sterility mosaic have been identified (Nene *et al*. 1981, Nene *et al*.1989, Amin *et al*. 1993). However, the resistance breakdown was noticed in recent years in few pigeonpea cultivars. There is an urgent need to screen the large genotypes /germplasm by using different transmission techniques for sterility mosaic disease so that tolerant/resistant lines can be used for the development of resistant variety for the disease.

MATERIALS AND METHODS

The present study was conducted during *kharif* 2003-2004 in the Department of Mycology and Plant Pathology, Institute of Agricultural Sciences, Banaras Hindu University. The experimental material consisted of 82 pigeonpea genotypes of medium to long duration. In field condition, 82 genotypes were screened by using Infector hedge technique (Nene and Reddy ,1976 b) as well as leaf stapling technique.Out of 82 genotypes, 22 genotypes were screened for sterility mosaic disease by using leaf stapling technique (Nene and Reddy , 1976 a) and petiole grafting technique(Reddy *et al.*, 2002) in pots.

Screening of pigeonpea genotypes by leaf stapling technique :

Ten selfed seeds of each of 22 genotypes of pigeonpea were sown in three pots (30 cm in diameter) filled with field soil on 1st October 2003. Every plant of each genotype was inoculated with disease leaflet at the age of 15 days adopting leaf stapling technique. The genotype ICP 8863, highly susceptible to SMD served as control. The inoculated plants were regularly monitored to observe the incidence of sterility mosaic. The per cent disease incidence was calculated as mentioned below :

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

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Screening of pigeonpea genotypes by petiole grafting technique :

The experiment was conducted in pot culture under polyhouse condition. Ten selfed seeds of each of 22 genotypes of pigeonpea were sown, in three pots (30 cm in diameter) filled with field soil on 1st October 2003. Each pot served as one replication. The plants of each pot at the age of 21 days were inoculated with SMD infected leaves adopting petiole grafting technique. The genotype ICP 8863 (highly susceptible to SMD) was inoculated at the same time to serve as control. The inoculated plants were regularly monitored to observe the incidence of sterility mosaic. The per cent disease incidence was calculated as mentioned above.

Screening of pigeonpea genotypes by Infector hedge technique and Leaf stapling technique :

The experiment was also conducted in the field condition. Eighty-two genotypes of pigeonpea belonging to different maturity groups were sown in the field in the first week of August, 2003. Seeds of each genotype were sown at the spacing of 20 cm in a 5 meter long row at the distance of 60 cm. The genotype ICP 8863, most susceptible to SMD was planted after every four rows of the test genotype. Each genotype was grown in three replications. Uniform spread of sterility mosaic was maintained by inoculating susceptible row of genotype (ICP 8863) with the diseased leaf adopting leaf-stapling technique. Incidence of disease was recorded at pre-flowering, flowering and podding stages of crop. Type of symptoms exhibited by each genotype was recorded as severe mosaic, mild mosaic and ring spot symptoms. The per cent disease incidence was calculated adopting formula mentioned above. On the basis of per cent disease incidence, the genotypes were grouped as highly resistant (0.0 to 0 %), resistant (0.1 to 10 %), moderately resistant (10.1 to 25 %) and susceptible (25.1 to 100%).

Results and Discussion

Screening of pigeonpea genotypes by Leaf stapling technique and Petiole grafting technique:

All the 22 genotypes (Table 1) except TT 701 and SM 03-17 exhibited the symptoms of disease. When inoculated by adopting both leaf stapling and petiole grafting techniques. The genotype TT 701 did not show any symptom of SMD when inoculated by adopting both the techniques and hence was grouped as highly resistant to mite and pigeonpea sterility mosaic virus.(PPSMV). However, genotype SM-03-17 was highly resistant when inoculated adopting leaf stapling technique but showed symptom of SMD when inoculated by petiole grafting technique. This genotype was grouped as resistant to mite and susceptible to pigeonpea sterility mosaic virus (PPSMV). The per cent incidence in most of the genotypes was higher in graft inoculation method than that of leaf stapling method. However, genotypes BDN-708, GAUT-011, PT- 1037 and H 94-6 showed low disease incidence when inoculated by graft inoculation method as compared to leaf stapling method.

Screening of pigeonpea genotypes against sterility mosaic disease :

The performance of 82 genotypes screened against sterility mosaic is presented in Table 2. The genotype ICP 8863 was found highly susceptible to SMD showing 80-100% disease incidence indicating good spread of disease. Out of 82 genotypes tested against sterility mosaic, sixteen were free from disease and grouped as highly resistant, fourteen genotypes were resistant with 0.1 to 10 per cent disease incidence, while twenty seven genotypes were moderately resistant showing 10.1 to 25 per cent incidence of disease. Rests of the genotypes were susceptible to highly susceptible showing 25.1 to 100 per cent of disease incidence.

Infector hedge technique adopted during the present study showed the high possibility of passive transmission of sterility mosaic. The disease incidence was the highest in susceptible genotype ICP-8863. Nene *et al.* (1981) have also reported the passive transmission of sterility mosaic through infector hedge technique. As it is evident that sap transmission is not possible in pigeonpea as described by Seth (1962), the virus transmission ability may be due to its vector mite *(Aceria cajani)*. The results of graft inoculation technique convey the active transmission of virus from disease scion to healthy stock plant. It is reasonable that graft inoculation method can be utilized to check the possibility of resistance in pigeonpea against sterility mosaic virus. This result corroborates the finding of Reddy *et al.* (2002), who have reported 86.6% infection percentage by petiole graft inoculation method. Results from leaf stapling technique showed that efficiency of transmission is directed by mite (*Aceria cajani*). This method seems to be quite encouraging in judging the resistance of pigeonpea genotypes against mites. Srinivas *et al.* (1997) reported a good spread of disease by leaf stapling technique, showing the disease incidence range upto 100% in susceptible genotypes. Results on comparative study the techniques of leaf stapling and petiole grafting technique used for screening of pigeonpea genotypes revealed that genotypes which showed severe mosaic in leaf stapling technique were also susceptible in petiole

Table 1: Screening of pigeonpea genotypes using stapling and graft inoculation method.

S. No.	Genotype	Leaf Stapling Method			Graft inoculation method		
		Disease incidence (%)	Days Post inoculation	Level of susceptibility	Infection (%)	DPI	Level of susceptibility
1	ICP 8863	86.3	59	SM	90.0	65	SM
2	JKM 192	38.9	85	MM	40.0	86	MM
3	Pant A-232	40.0	59	MM	59.2	61	MM
4	TT 701	0.0	00	NS	0.0	00	NS
5	JKM 189	45.5	59	SM	50.0	60	SM
6	CORG 9701	40.9	80	MM	42.3	71	MM
7	BSMR 846	44.4	85	MM	50.0	68	MM
8	GAUT 0202	60.0	85	SM	70.0	84	SM
9	BSMR 736	51.1	59	MM	65.0	63	MM
10	SKNP 0111	55.0	101	MM	72.7	80	MM
11	JJ 65	20.0	95	MM	23.0	78	MM
12	SM 03-17	0.0	00	NS	13.6	81	MM
13	BDN 708	65.0	85	SM	37.0	87	SM
14	GAUT 0201	40	43	MM	59.6	49	MM
15	GAUT 011	61.1	85	MM	47.8	81	MM
16	BDN 2	40.0	85	MM	53.8	80	MM
17	PT 1037	44.4	85	MM	42.3	88	MM
18	H 94-6	18.8	37	SM	15.0	66	SM
19	TT 201	10.5	65	MM	11.5	78	MM
20	H 97-24	73.6	95	SM	68.1	76	SM
21	AL 1483	75.0	59	MM	80.0	61	MM
22	BDN 2009	45.0	85	SM	70	80	SM

Note:-
DPI= Days Post Inoculation, SM = Severe mosaic MM = Mild mosaic NS = No symptom

grafting technique and showed similar type of symptoms. Genotype SM-03-17 was highly resistant in leaf stapling technique but susceptible in petiole grafting technique. This finding indicates that genotype SM-03-17 may be resistant to mite which did not like to feed on but susceptible to virus. During screening of 82 genotypes against sterility mosaic, 16 genotypes were highly resistant and 14 genotypes were resistant. These genotypes may be used as donor by the breeder for the development of high yielding variety of pigeonpea. The first symptom appeared after

Table 2: Screening of pigeonpea genotypes for sterility mosaic disease resistance :

S. No.	Genotype	Average infection (%) at different stages			Mean	Disease reaction
		Pre-Flowering	Flowering	Podding		
1.	ICP 8863	78.4	82.5	85.0	81.9	S
2	BDN 2	22.2	31.2	32.1	28.5	S
3	PT 1037	16.6	16.8	18.7	17.4	MR
4	H 94-6	0	0	0	0	HR
5	BDN 2010	0	0	0	0	HR
6	WRG 53	17.6	17.6	17.6	17.6	MR
7	TT 103	65.7	69.9	69.9	68.5	S
8	AL 1483	46.6	63.3	64.1	58.1	S
9	BSMR 846	24.2	41.6	38.9	34.9	S
10	AL 1491	23.3	67.8	74.9	53.3	S
11	JKM 189	61.8	56.4	55.2	57.8	S
12	WRG 56	56.2	36.9	28.9	40.6	S
13	SKNP 0111	36.5	60.7	45.4	47.5	S
14	GAUT 0201	57.8	55.2	55.2	56	S
15	BDN 2009	41.34	48.9	42.3	44.2	S
16	UPSA 2003-2	71.4	66.9	75.7	71.3	S
17	JKM 192	18.8	30.2	28.2	25.7	S
18	GAUT 0202	61.7	34.7	34.7	43.7	S
19	Pant A 232	19.6	17.1	22.7	19.8	MR
20	BDN 708	33.3	33.3	31.5	32.7	S
21	H 97-24	59.4	36.7	39.3	45.1	S
22	SM 03-17	0	0	0	0	HR
23	JJ 65	15.5	15.4	15.4	15.4	MR
24	PT 8208-1	16.8	19.5	18.6	18.3	MR
25	GAUT 011	59.1	48.1	43.8	50.3	S
26	BSMR 736	17.7	16.7	16.7	17.0	MR
27	CROG 9701	55.4	34.3	35.7	41.8	S
28	Pant A 232	29.9	34.5	21.8	28.6	S
29	UPSA 2003-1	15.8	28.3	25.6	23.2	MR
30	Pant A 286	36.6	45	30.4	37.3	S
31	TT 201	22.2	22.2	28.6	24.3	MR
32	NDA 94-1	0	0	0	0	HR
33	NDA 98-2	7.9	7.69	0	5.2	R
34	NDA 99-6	3.7	6.2	10.8	6.9	R
35	KPL 44	0	0	7.2	2.6	R
36	Pant A 232	33.8	28.8	28.8	30.5	S
37	DA 11	0	0	0	0	HR
38	NDA 99-1	0	0	0	0	HR
39	NDA 96-1	0	0	0	0	HR
40	ICP 87119	27.1	24.1	28.6	26.6	S

Table 2 Contd……..

41	BSMR 736	0	0	0	0	HR
42	Amar	0	6.7	7.1	4.6	R
43	NDA 98-1(w)	0	0	0	0	HR
44	NDA 98-1(b)	15.8	10.5	5.5	10.6	MR
45	MAL 6	10.4	10.3	10	10.2	MR
46	KPL 13	0	0	0	0	HR
47	ICP 7119	16.6	5.5	6.3	9.4	R
48	MAL 3	22.2	16.7	16.9	18.6	MR
49	Bahar	0	0	0	0	HR
50	NDA 98-3	8.9	5.6	5.7	6.7	R
51	NDA 98-6	6.7	0	0	2.3	R
52	NDA 96-6	0	0	0	0	HR
53	Azad	5.9	5.8	5.9	5.8	R
54	NDA 03-3	15.3	18	3.9	15.8	MR
55	NDA 2001-2	11.6	11.6	12.2	11.8	MR
56	MAL 18	0	0	0	0	HR
57	IPA 3-1	15.1	18.4	18.4	17.3	MR
58	Kawar 92-02	9.5	17.6	10.7	12.6	MR
59	IPA 13	14.2	14.4	12.2	13.7	MR
60	IPA 1-3	29.2	33.3	30.7	31.2	S
61	NA 1	19.4	19.1	14.9	17.8	MR
62	KBA 7-3	22.8	19.5	19.5	20.6	MR
63	KBA 22-1	7.9	8.2	8.1	8	R
64	IPA 1-1	19.4	22.3	22.2	21.3	MR
65	MAL 21	5.3	5.3	0	3.6	R
66	MAL 20	12.7	8.5	5.4	8.9	R
67	ICP 3-2	10.1	12.5	12.5	11.7	MR
68	MAL 9	29.7	10.1	11.7	11.1	MR
69	BSMR 854	23.5	23.5	23.5	23.5	MR
70	BSMR 852	6.3	12.5	12.5	10.4	MR
71	WRG 29	18.2	18.2	10	15.4	MR
72	S 6 Bahar Sel 16-5	4.5	10.9	6.6	7.3	R
73	MAL 19	26.6	23.3	20	23.3	MR
74	285-96-SPS-17	50	51.2	50	50.4	S
75	MA 6	13.3	13.3	21.4	16	MR
76	MAL 19	0	0	0	0	HR
77	2 KM 11	0	0	0	0	HR
78	LDPRL 2	0	0	0	0	HR
79	MAL 15	29.6	10.1	11.7	17.1	MR
80	286-94-29-1	0	7.1	7.7	4.9	R
81	ICP 9174	35.1	43.3	43.3	40.6	S
82	ICP 983	10.5	8.3	8.7	9.2	R

HR = Highly resistant (0.0 %), R = Resistant (0.1 – 10 %), MR= Moderately resistant (10.1 – 25 %)
S = Susceptible (25.1 – 100 %)

35 days of inoculation and reached maximum 100 days after inoculation. Progress of disease incidence occurs only upto pre-flowering stage beyond which the possibility of disease occurrence reduces.

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