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Identification of fertility restorer and sterility maintainer lines in chilli (*Capsicum annuum* L.)¹

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Abstract

Three cytoplasmic genic male sterile lines of chilli (*Capsicum annuum* L.) namely, JNKVVA1, ACBGA1 and ACBGA2 showed 100% male sterility when tested with 1% acetocarmine solution. Among the 50 chilli lines crossed with the three male sterile lines, 36 lines were stable for fertility restoration (Rf) while, two lines namely, AVNPC131 and X235 were identified as sterility maintainers (rf).

Keywords: chilli hybridization, inbred segregation, stable restorers, sterility maintainers

The process of emasculation and pollination in chilli (*Capsicum annuum* L.) for hybrid seed production is a cumbersome practice. Utilization of a stable commercial viable male sterility source in chilli would help in making the hybridization process easy and economically viable. In the present study, three cytoplasmic male sterile lines were evaluated to identify stable male sterile lines.

Three cytoplasmic genetic male sterile lines namely, JNKVVA1, ACBGA1 and ACBGA2 were grown in a shade house from 15th August 2008 to 30th June 2009 at Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (Madhya

Pradesh). ACBGA1 and ACBGA2 were obtained from University of Agricultural Sciences, Dharwad and JNKVVA1 from Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur. On the basis of pollen dehiscence the plants were classified as male fertile or male sterile. The number of stained pollen grains was evaluated by microscopic examination (Gulyas *et al.* 2006). Cytoplasmic male sterility is important in many crops for F₁ hybrid seed production as well as for research on nuclear mitochondrial interaction (Chase 2007). Fifty chilli lines were crossed with each of the three male sterile lines to produce 150 F₁ hybrids

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during kharif 2008 and sown in shade house as well as in the field. Based on their fertility restoration, inbred plants were classified into three categories: (i) stable for fertility restoration (Rf) (ii) stable for sterility maintainer (rf) and (iii) inbred plants still segregating (Rf/rf) (Kumar *et al.* 2007).

Out of the 150 F₁ fertility was restored in 117, partially restored in 21 and sterility was maintained in 12 when tested during summer 2009 in shade house conditions in pots (Table 1). Under shade house during kharif 2009, fertility was restored in 109, partially restored in 30 and sterility maintained in 11 (Table 1). However, under field conditions, fertility was restored in 116, partially restored in 24 and sterility maintained in 10 hybrids (Table 1). Variations were observed for the presence of fertility restorer gene Rf in the genotypes used as male on CMS lines.

Table 1. Fertility restorer, sterility maintainer and segregating lines under shade house and field condition in chilli

Total hybrids	Fertility restorer	Partial restorer	Sterility maintainer
Net house			
150	117	21	12
Shade house			
150	109	30	11
Field			
150	116	24	10

The stable restorers (lines which restore fertility after crossing with all three sterile lines) as well as sterility maintainer lines (lines which restore sterility after crossing with all three sterile lines) are presented in Table 2. Among the 50 lines, 36 lines, namely, Shankeswar, JM-218, Pant C-1, G-4, K1-4, 9608U, BVC-1, GUK-1, GUK-2, GUK-2-1, GUK-2-1-1, IC119578, IC119561, LCA-235, LCA-304, LCA-310, LCA-310A, LCA-334, LCA-960, KDC-1, GPC-82, D. DABBI, KDSC210-10-3, KDSC210-10-4, KDSC210-10, SUM05-2R, P. JWALA, KA-2, K1-4 D, HMT-1,

B. Kaddi, Jayanti, GCV111, GCV131, P. Sadabahar and BVC-37, were stable for fertility restoration (Rf) while, two lines namely, AVNPC131 and X235 were identified as sterility maintainers (rf) whereas, remaining 12 lines namely, Phule Jyoti, Hisar Vijay, H0413, IC119243, IC112109, KDSC210-10-1, KDSC210-10-2, KDSC510-10-1, KDSC510-10-2, KDSC510-10, HCS-3 and JM-283 were found segregating (Rf/rf). Fertility restoration analysis revealed presence of fertility restoration gene Rf in majority of the lines. Similar findings have also been reported earlier in chilli by testing different lines (Kumar *et al.* 2004; Singh *et al.* 2006).

It could be concluded from the study that all the three male sterile lines were stable for cytoplasmic male sterility over different seasons at Jabalpur. Fertility restoration analysis revealed the presence of fertility restoration and sterility maintainer gene in thirty six and two lines respectively. Majority of the lines exhibited fertility restoration gene (Rf) whereas, only two lines namely, AVNPC131 and X235 exhibited sterility maintainer gene (rf). Hence, these two lines may be used for conversion into male sterility through back crossing to create genetic variability for male sterility in chilli.

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Table 2. Stable fertility restorer and sterility maintainer lines in chilli

Sl. No.	Lines used as male	F ₁ plant population	Tester used as female (CGMS)						Remark
			JNKVVA1		ACBGA1		ACBGA2		
			Fertile	(%) fertile plants in F ₁	Fertile	(%) fertile plants in F ₁	Fertile	(%) fertile plants in F ₁	
1	Sankeshwar	40	40	100	40	100	40	100	Rf
2	JM-218	40	40	100	40	100	40	100	Rf
3	Pant C-1	40	40	100	40	100	40	100	Rf
4	G-4	40	40	100	40	100	40	100	Rf
5	K1-4C	40	40	100	40	100	40	100	Rf
6	9608U	40	40	100	40	100	40	100	Rf
7	BVC-1	40	40	100	40	100	40	100	Rf
8	GUK-1	40	40	100	40	100	40	100	Rf
9	GUK-2	40	40	100	40	100	40	100	Rf
10	GUK-2-1	40	40	100	40	100	40	100	Rf
11	GUK2-1-1	40	40	100	40	100	40	100	Rf
12	IC119578	40	40	100	40	100	40	100	Rf
13	IC119561	40	40	100	40	100	40	100	Rf
14	LCA-235	40	40	100	40	100	40	100	Rf
15	LCA-304	40	40	100	40	100	40	100	Rf
16	LCA-310	40	40	100	40	100	40	100	Rf
17	LCA-310A	40	40	100	40	100	40	100	Rf
18	LCA-334	40	40	100	40	100	40	100	Rf
19	LCA-960	40	40	100	40	100	40	100	Rf
20	KDC-1	40	40	100	40	100	40	100	Rf
21	GPC-82	40	40	100	40	100	40	100	Rf
22	D. DABBI	40	40	100	40	100	40	100	Rf
23	KDSC210-10-3	40	40	100	40	100	40	100	Rf
24	KDSC210-10-4	40	40	100	40	100	40	100	Rf
25	KDSC210-10	40	40	100	40	100	40	100	Rf
26	SUM05-2R	40	40	100	40	100	40	100	Rf
27	P. jwala	40	40	100	40	100	40	100	Rf
28	KA-2	40	40	100	40	100	40	100	Rf
29	K1-4 D	40	40	100	40	100	40	100	Rf
30	HMT-1	40	40	100	40	100	40	100	Rf
31	B. Kaddi	40	40	100	40	100	40	100	Rf
32	JAYANTI	40	40	100	40	100	40	100	Rf
33	GCV111	40	40	100	40	100	40	100	Rf
34	GCV131	40	40	100	40	100	40	100	Rf
35	P. Sadabahar	40	40	100	40	100	40	100	Rf
36	BVC-37	40	40	100	40	100	40	100	Rf
37	AVNPC131	40	00	00	00	00	00	00	rf
38	X235	40	00	00	00	00	00	00	rf
39	Phule Jyoti	40	36	90	35	87.5	40	100	Rf/rf
40	Hisar Vijay	40	35	87.5	36	90	40	100	Rf/rf
41	H0413	40	35	87.5	38	95	25	62.5	Rf/rf
42	IC119243	40	40	100	26	65	40	100	Rf/rf
43	IC112109	40	34	85	40	100	00	00	Rf/rf
44	KDSC210-10-1	40	32	80	35	87.5	13	32.5	Rf/rf
45	KDSC210-10-2	40	34	85	27	67.5	25	62.5	Rf/rf
46	KDSC510-10-1	40	40	100	35	87.5	40	100	Rf/rf
47	KDSC510-10-2	40	34	85	00	00	35	87.5	Rf/rf
48	KDSC510-10	40	34	85	00	00	00	00	Rf/rf
49	HCS-3	40	40	100	00	00	00	00	Rf/rf
50	JM-283	40	27	67.5	26	65	28	70	Rf/rf

Rf=Fertility restoration; rf=sterility maintainer