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Minakshi Jain
Assistant Seed Certification
Officer, Rajasthan State Seeds
and Organic Production
Certification Agency, Kharkhana
Bagh Police Line, Kota,
Rajasthan, India

Rupinder Kaur
Department of Plant Breeding
and Genetics College of
Agriculture, Punjab Agricultural
University, Ludhiana, Punjab,
India

Surendra Singh Yadav
Seed Officer, Rajasthan State
Seeds Corporation Ltd. Police
Line, Kota, Rajasthan, India

Phenotypic characterization of new cytoplasmic male sterile lines in rice (*Oryza sativa* L.)

Minakshi Jain, Rupinder Kaur and Surendra Singh Yadav

Abstract

Characterization of 11 bacterial blight resistant new CMS lines was done for characters like plant height, days to 50 per cent flowering, ear bearing tillers per plant, panicle length, number of spikelets per panicle, panicle exertion, flag leaf length, angle of floret opening, duration of floret opening and stigma length in rice. The F-test showed the presence of highly differences among 11 genotypes for all the traits evaluated. Significant variation was recorded among the different group of genotypes studied viz., CMS lines for all the characters. PMS 27A and PMS 31A were identified desirable in most of traits like early maturity, short height, good panicle length, good panicle exertion and stigma length. PMS 17A showed good panicle exertion, good number of spikelets and wider opening of lemma and palea. PMS 24A excelled in panicle length, stigma length, angle of opening of lemma and palea. CMS lines having characteristics like early maturity, short height, good panicle length and panicle exertion and stigma length has made a significant influence on out crossing rate.

Keywords: CMS Lines, rice, PMS, *Oryza sativa*

Introduction

Rice, the principle staple food for more than half of the world's population, occupies a pivotal place in global food and livelihood security systems. Characterization of genotypes of a crop is important to evaluate and plan the use of elite germplasm in hybrid breeding. Attempts are being made to develop rice hybrids by exploiting the available male sterile system. Seed production in hybrid rice depends on the availability of favorable floral traits of two parents. In hybrid rice development programme the use of male sterile lines is an important criteria of orient the development of new male sterile lines. Higher yield in hybrid seed production depends on CMS lines and out crossing rate is influenced by various morphological and floral traits. Information on floral biology of rice CMS and restorer line is very limited. However, studies on floral trait advocate that wider angle of floret opening and longer stigma considerably improves the seed set in male sterile genotypes.

The use of male sterility is pre requisite for commercial exploitation of heterosis since rice is a self-pollinated crop. Salgotra *et al* (2009) [4] studied the influence of various traits viz., angle of open lemma and palea, stigma length, panicle exertion (%), days to 50 per cent flowering, effective tillers per plant seed set (%). They concluded that floral traits like panicle exertion, angle of opened lemma and palea and stigma size are mainly responsible for influencing seed setting per cent in CMS lines of rice. According to him for further breeding of new CMS lines, panicle exertion angle of opened lemma and palea and stigma size should be given greater importance.

Availability of stable CMS and fertile restoration system is vital for commercial exploitation of heterosis in any crop. So evaluation of newly developed CMS lines of rice for their morphological and floral traits to determine variation among genotypes is essential so that phenotypically excellent lines could be exploited for development of rice hybrids in order to identify genotypes with desirable morphological and floral traits, 11 bacterial blight resistant new CMS lines were evaluated for ten characters.

Materials and methods

Eleven CMS lines and their corresponding maintainer lines of diverse sources formed the material for the present study. CMS and maintainer lines were planted in three rows per plots having 12 hills per row with spacing of 20 x 15 cm apart. Field evaluation was conducted at Rice Experiment Area, Department of Plant Breeding and Genetics, Punjab Agriculture University, Ludhiana during Kharif 2011 [1].

Observations were recorded on five randomly selected plants of each CMS line and their corresponding maintainer in each replication for various morphological and floral traits viz,

Correspondence

Minakshi Jain
Assistant Seed Certification
Officer, Rajasthan State Seeds
and Organic Production
Certification Agency, Kharkhana
Bagh Police Line, Kota,
Rajasthan, India

plant height, days to 50% flowering, ear bearing tillers per plant panicle length, number of spikelets per panicle. Panicle exertion, flag leaf length, angle of floret opening, duration of floret opening and stigma length. The data recorded on 11 CMS lines for morphological and floral traits were subjected to the following analysis by using the software CPCS-1. The mean data were subjected to variance analysis and test of significance as per the method of Fisher (1935) [13].

Results and discussion

Characterization of 11 bacterial blight resistant new CMS lines was done for characters like plant height, days to 50 per cent flowering, ear bearing tillers per plant, panicle length, number of spikelets per panicle, panicle exertion, flag leaf length, angle of floret opening, duration of floret opening and stigma length. The analysis of variance presented in Table 16. The F-test showed the presence of highly differences among 11 genotypes for all the traits evaluated. Significant variation

was recorded among the different group or genotypes studied, viz., CMS lines for all the characters (Table 1).

In Punjab conditions, CMS lines having characteristic like early maturity, short height good panicle length, panicle exertion and stigma length has made a significant influence on out crossing rate. PMS 27A and PMS 31 A were identified desirable in most of traits like early mature, short height, good panicle length, good panicle exertion and stigma length. PMS 17A showed good panicle exertion, good number of spikelets and wider opening of lemma and palea. PMS 24A excelled in panicle length, stigma length, angle of opening of lemma and palea.

To enhance the efficiency of hybrid seed production, it is necessary to increase the yield of hybrid seed by improving the out crossing capacity of CMS lines (Yang *et al* 2006 and Cheng *et al* 2007) [6, 2].

Table 1: Analysis of variance for various outcrossing traits

Source	d.f.	Panicle height	Panicle length	Days to 50% flowering	Ear bearing tillers/plant	Spikelets per panicle	Flag leaf length	Duration of floret opening	Angle of floret opening	Panicle exertion	Stigma length
Replicates	1	1.03	.56	18.37**	1.52**	215.97	15.04**	6.04	7.04	1.11	0.0004
Treatments	10	104.8**	2.79*	121.64**	0.32**	1504.25**	25.31**	246.8**	4.64*	48.2**	0.05**
Error	10	3.86	.89	17.64	0.40	44.82	2.67	6.81	1.31	29.12	0.0002
CD (5%)		4.32	2.07	9.24	NS	14.72	3.6	5.74	2.52	NS	0.03
C.V		1.97	3.96	4.16	6.60	3.75	4.34	1.48	4.43	6.79	1.42

Table 2: Mean performance of CMS lines for outcrossing traits

CMS lines	Days to 50% flowering	Plant height (cm)	Panicle length (cm)	Panicle exertion (%)	Flag leaf length (cm)	Ear bearing tiller per plant	Spikelets per panicle	Stigma length (mm)	Angle of floret opening (°)	Duration of floret opening (Min.)
PMS 22A	106	99	22.7	76.5	40	10	175	1.45	25.0	165
PMS 23A	109	97	22.3	77.3	41	9	165	1.21	26.5	161
PMS 24A	102	102	25.8	74.2	39	10	199	1.25	27.5	182
PMS 26A	96	111	24.4	85.5	42	10	205	1.05	27.0	171
PMS 27A	91	90	24.6	80.1	40	9	168	1.16	24.0	161
PMS 28A	96	116	24.3	79.8	38	10	133	.82	23.5	173
PMS 29A	95	95	22.9	76.5	35	9	160	1.05	25.0	196
PMS 30A	90	99	21.8	75.2	38	11	221	1.00	25.0	184
PMS 31A	94	95	24.9	89.5	32	9	140	1.11	25.5	190
PMS 32A	111	98	23.6	73.4	33	9	181	.99	28.5	180
PMS 17A	109	96	24.5	83.2	38	11	212	1.03	26.5	174
Average	100.67	99.58	23.8	79.45	37.75	9.59	178	1.09	25.87	175.83
S.E.	3.86	.89	17.64	0.40	44.82	2.67	6.81	1.31	29.12	0.0002

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