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Variability, Heritability and Genetic Advance for Floral, Morphological and Agronomic Traits of Cytosterile Lines in Rice

Key words : Variability, Heritability, Genetic Advance, CMS lines.

Rice is an important cereal crop of Andhra Pradesh and production of hybrids is the need of the hour to meet the future demands. It is essential to have a thorough knowledge on the variability present in the male sterile germplasm lines to aim at increasing the outcrossing rate achieving higher hybrid seed production.

In the present experiment, 15 diverse CMS lines were sown at Andhra Pradesh Rice Research Institute and Regional Agricultural Research Station (APRRI and RARS), Maruteru (Table1). One month old seedlings were transplanted in randomized block design with three replications. Each genotype was transplanted with two rows of A line and two rows of corresponding B line. Observations were recorded on ten plants selected at random or on plot basis from each replication for characters *viz.,* plant height, days to 50% flowering, number of productive tillers per plant, panicle length, panicle exertion percentage, flag leaf angle, flag leaf length, flag leaf width, anther length, stigma length, stigma exertion percentage, pollen sterility percentage, number of filled spikelets per panicle, angle of floret opening, duration of floret opening, number of spikelets per panicle and outcrossing percentage. The mean of the replications was used for statistical analysis.

The analysis of variance revealed that the genotypes differed significantly for all the characters indicating considerable variation among the genotypes. Genotypic and phenotypic coefficients of variation were high for number of spikelets per panicle (Table 2). Similar findings were also reported by Saravanan and Senthil (1997). GCV and PCV were moderate for flag leaf angle, duration of floret opening, flag leaf length, flag leaf width and stigma exertion per cent while, low for plant height, days to 50 per cent flowering, panicle length, panicle exer etion per cent, angle of floret opening, stigma length and anther length. These were in conformity with Kaw *et al*. (1999), Saravanan and Senthil (1997), Manonmani *et al.* (1996), Nath and Talukdar (1997) and Banumathy *et al*. (2002).

Number of spikelets per panicle, flag leaf angle, duration of floret opening, flag leaf length, stigma exertion percentage and outcrossing per cent showed high heritability and high genetic advance coupled with moderate to high variability indicating the predominance of additive gene action and improvement of these traits could be anticipated with simple selection. Banumathy *et al.* (2001) and Sheeba *et al.* (2006) reported similar findings for these traits.

Low variability, low heritability and genetic advance were recorded for outcrossing per cent, indicating the influence of non-additive gene action in controlling the expression of this trait. Hence simple phenotypic selection for this trait may not be fruitful as this character is highly influenced by the environment.

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Table 1. Mean performance of 15 CMS lines for 15 characters in rice (*Oryza sativa* L.)

No	Character / CMS line	1 Plant height (cm)	2 Days to 50% flowering	3 No of productive tillers plant^{-1}	4 Panicle length (cm)	5 No of spikelets panicle^{-1}	6 Panicle exertion %	7 Angle of floret opening (0)	8 Flag leaf angle (0)
1	IR 80151 A	88.3000	91.3333	9.5567	25.5100	202.8667	70.7800	25.0667	25.8967
2	PUSA 5A	80.8667	90.3333	8.8900	24.1433	171.6667	75.1667	24.5000	25.6267
3	PMS 17A	77.8667	92.3333	8.3333	25.5533	306.6667	73.3933	23.2600	16.5000
4	IR 80555 A	72.5333	86.0000	9.8900	25.6000	178.6667	68.2833	21.2667	25.5333
5	IR 68897 A	71.4000	85.6667	8.3300	26.9433	191.0000	73.9333	22.5667	24.7233
6	IR 80155 A	77.2000	86.0000	7.3333	25.9667	229.3333	78.3500	23.4033	25.4500
7	CRMS 32A	81.3333	92.6667	8.7767	25.6100	227.6667	64.7000	22.4333	22.0000
8	IR 80561 A	73.1000	85.6667	9.3333	26.3567	229.0000	73.9000	25.4667	28.1667
9	APMS 6A	71.6333	90.3333	7.1133	26.9533	265.6667	77.5367	22.8333	25.4400
10	APMS 8A	80.7667	95.3333	9.3300	24.4467	296.5333	73.5667	21.5333	25.5033
11	APMS 9A	89.9667	93.6667	9.0000	24.8333	288.8667	86.3667	22.8333	25.0000
12	IR 58025 A	78.1200	86.6667	9.3333	25.8767	312.3333	73.5667	21.5567	18.4433
13	PMS 3A	78.6333	94.0000	9.6667	24.9433	226.3333	71.4067	22.5667	16.3333
14	PMS 10A	74.7333	94.0000	10.0000	25.1333	217.0000	75.2667	23.1667	25.5800
15	IR 62829 A	75.3333	80.6667	10.2233	23.6000	163.0000	70.7667	21.0000	16.0667
	Mean	**78.1191**	**89.6444**	**9.0073**	**25.4313**	**233.7733**	**73.7989**	**22.8969**	**23.0842**
	C.V.	5.4650	1.5562	10.1099	3.8551	9.9494	3.2282	6.4676	7.6323
	C.D. 5%	7.1404	2.3332	1.5231	1.6398	38.9015	3.9846	2.4768	2.9468
	S.E ±	2.4648	0.8054	0.5258	0.5660	13.4287	1.3755	0.8550	1.0172

Table 1. Cont.....

No	Character / CMS line	9 Duration of floret opening (min)	10 Flag leaf length (cm)	11 Flag leaf width (cm)	12 Stigma length (mm)	13 Anther length (mm)	14 Stigma exertion %	15 Out crossing %
1	IR 80151 A	183.3333	24.0000	1.5000	1.7100	1.8233	51.0333	21.9333
2	PUSA 5A	185.0800	23.5000	1.6667	1.6567	1.7533	49.4333	26.8667
3	PMS 17A	134.7667	24.0667	1.8333	1.5967	1.5500	33.9000	19.7667
4	IR 80555 A	188.7767	29.5667	1.5000	1.6133	1.8133	46.0333	19.6867
5	IR 68897 A	153.0000	30.3333	1.3000	1.8833	1.7800	51.3000	24.1333
6	IR 80155 A	162.0000	26.5333	1.6000	1.6833	1.7333	51.3333	29.3333
7	CRMS 32A	162.5000	32.4000	1.6667	1.6600	1.6367	43.6333	17.7000
8	IR 80561 A	181.6667	28.5667	1.7667	1.7167	1.8133	54.6000	21.6000
9	APMS 6A	158.7833	28.0000	1.8667	1.6733	1.7400	50.4667	22.7333
10	APMS 8A	155.6667	29.0000	1.8667	1.6033	1.6233	35.6333	18.0000
11	APMS 9A	161.9800	29.9333	2.1000	1.6233	1.5967	49.4667	22.6000
12	IR 58025 A	117.3333	40.4000	1.5667	1.6000	1.6400	46.9000	15.5000
13	PMS 3A	151.5000	29.7667	1.7667	1.4933	1.5733	45.4000	19.2667
14	PMS 10A	158.6667	24.5000	1.6667	1.6467	1.7300	52.5000	22.1333
15	IR 62829 A	102.1667	31.5000	1.4667	1.5967	1.6300	42.3333	13.5000
	Mean	**157.1480**	**28.8044**	**1.6756**	**1.6504**	1.6958	46.9311	20.9836
	C.V.	2.0907	5.8299	9.0948	3.9290	4.4181	5.2419	10.7752
	C.D. 5%	5.4950	2.8086	0.2549	0.1085	0.1253	4.1146	3.7816
	S.E ±	1.8968	0.9695	0.0880	0.0374	0.0433	1.4203	1.3054

Table 2. Mean , range, genetic variability, heritability (broad sense) and genetic advance as per cent of mean for out crossing per cent and its component traits for 15 CMS lines in rice (*Oryza sativa* L.)

S.No	Character	Mean	Range		Coefficient of variation		Heritability % (Broad sense)	Genetic advance as per cent of mean
			Minimum	Maximum	PCV (%)	GCV(%)		
1	Plant height (cm)	78.12	71.40	89.97	8.40	6.38	57.70	10.00
2	Days to 50% flowering	89.64	80.67	95.33	4.92	4.67	90.00	9.12
3	No of productive tillers plant^{-1}	9.00	7.11	10.22	13.07	8.28	40.20	10.82
4	Panicle length (cm)	25.43	23.60	26.95	4.89	3.01	37.90	3.82
5	No of spikelets panicle^{-1}	233.77	163.00	312.33	22.76	20.47	80.90	37.92
6	Panicle exer-tion %	73.80	64.70	86.37	7.13	6.35	79.50	11.67
7	Angle of floret opening	22.90	21.00	25.47	7.84	4.44	32.00	5.17
8	Flag leaf angle	23.08	16.07	28.17	18.87	17.26	83.60	32.51
9	Duration of floret opening (min)	157.15	102.16	188.78	15.59	15.45	98.20	31.55
10	Flag leaf length (cm)	28.80	23.50	40.40	15.64	14.51	86.10	27.74
11	Flag leaf width (cm)	1.68	1.3.00	2.10	14.04	10.70	58.10	16.80
12	Stigma length (mm)	1.65	1.49	1.88	6.07	4.62	58.10	7.27
13	Anther length (mm)	1.69	1.55	1.82	6.56	4.86	54.70	7.40
14	Stigma exertion %	46.93	33.90	54.60	13.46	12.41	84.90	23.54
15	Out crossing %	20.98	13.50	29.33	21.39	18.48	74.60	32.88

PCV = Phenotypic coefficient of variation GCV = Genotypic coefficient of variation

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