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Evaluation of genetic variability of rice (*Oryza sativa* L.) germplasm for growth and yield contributing traits

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Abstract

The experiment was carried out at experimental area of Bharat Ratna, Dr. B. R. Ambedkar Samajik Vigyan Kendra, Bordhi, Sehore (M.P.) The present investigation entitled "evaluation of genetic variability of rice (*Oryza sativa* L.) Germplasm for yield and qualitative contributing traits" during kharif season 2018-19. The experiment was laid out in randomized block design with three replications with seventy two germplasm and three local check variety were evaluated in the present study.

Keywords: GCV, PCV, No of tillers, grain yield and days to 50% flowering

Introduction

Rice (*Oryza sativa* L.) is one of the important food grain crop of India and important member of family-Poaceae having chromosome no. $2n=24$, *Oryza* genus has 2 cultivated and 22 wild species and ranking first among the three major cereals followed by wheat and maize. On the basis of biochemical, morphological, physiological and molecular characteristics, it is classified into two cultivated sub species of Asian rice that is *Oryza sativa* variety japonica and *Oryza sativa* variety indica.

Rice is an annual plant and can be grown under a specious range of soil-water regimes, from a long time of floating in deep water to dry land on hills slopes. Though it is grown in various eco-systems, like upland, low land irrigated or rain-fed. The area, production and productivity of rice in India is 43.39 m ha, 108.32mt and 2404 kg/ha, respectively. Similarly in Madhya Pradesh it is also grown in an area of 1.93 m ha with a production of 2.74 mt and the productivity of 1768 kg/ha.

Rice is one of the main crop of India. Rice is main source of carbohydrate for more than half of the world's population. The production and consumption of rice in Asia is above 90 % of world's rice. Hence, increase in rice productivity is the urgent need to feed over increasing world's population, which can be achieved through the application of hybrid varieties in commercial cultivation along with proper utilization of land, water, chemicals and other inputs. The crop improvement is the best solution of enhancement of yield in rice.

In most of the cereals, the biggest germplasm accession has been conserved in various gene bank. These germplasm accession contains wild form, wild relatives, primitive races, obsolete varieties, varieties in cultivation constitutes the biggest reservoirs of genetic variability. The valuable desirable characters are present in landraces played very important role in the crop improvement programme. The importance of landraces is due to desirable gene present in them. The crop improvement programme will be effective by utilizing the genetic variability present in germplasms.

Material and Methods

The experiment was laid out in randomized block design with three replications and seventy two germplasm along with three local check variety were evaluated in the present study. The farm is situated under Malwa Plateau agro-climatic zone in Madhya Pradesh and situated geographically between the $22^{\circ} 44'$ N latitude and $77^{\circ} 43'$ E longitude and about 303 meter above mean sea level. Agro-ecologically Rehti is characterized by semi-arid and sub-tropical climate with hot dry summer and cold winters. The total mean annual rainfall of Rehti is 1119.1 mm in experimental area. Field preparation was done as per the recommended package and practices for the crop. Provision for the proper drainage was also made. The material consisted of seventy-two germplasm accessions collected from various areas of Jabalpur region (M.P.) with three local checks that is LC-767, LG-964 and MTU-1010.

Table 1: The material or germplasm used for investigation

S. No.	Entry number	Name of Germplasm	37	177	Samda
1	6	Badki Luchai	38	181	Sauthi
2	10	Badal phool	39	182	Sonkharchi
3	11	Baghmechha	40	187	Surja
4	12	Bagari	41	191	Hauhi
5	15	Banko	42	199	Bhalshankar
6	24	Bela	43	200	Pilkormera
7	25	Berjali	44	201	Shyamjeera
8	26	Bhata phool	45	203	Galari
9	27	Bhejari	46	204	Bilailuchai
10	33	Biranj	47	205	Badshahbhog
11	38	Chinmauri	48	208	Hardigathi
12	50	Dhaniyadhan	49	209	Shervani
13	52	Dilbaxa	50	210	Badshahprasan
14	55	Dubraj	51	211	Nevari
15	56	Doodhi	52	212	Kotava
16	58	Geeta	53	215	Durgaprasad
17	61	Hardgudi	54	217	Assamchidi
18	63	Jeeraphool	55	218	Koshamkhand
19	64	Jeerasar	56	219	Senkursar
20	72	Kanga	57	220	Keraphool
21	93	Karanphool	58	221	Bhaloodubraj
22	104	Karmodhan	59	228	Kadamphool
23	106	Kerakhambh	60	229	Turailuchai
24	111	Khansari	61	230	Phoolmechha
25	114	Kumhran	62	231	Hansraj
26	115	Kuthalidhan	63	238	Ajan
27	120	Lamera	64	243	Kannauji
28	135	Lohadhi	65	244	Kerakhambh
29	141	Malati	66	250	Kansari
30	142	Masooriya	67	257	Karagi
31	143	Nadawal	68	261	Kosamsar
32	154	Rajgauhi	69	267	Kalajeera
33	155	Ramkajari	70	290	Karahani
34	162	Safari	71	291	Katanga
35	167	SAiri	72	292	Kudurlai
36	172	Samasar	73	LC-767	
			74	LC-964	
			75	MTU-1010	

Result and Discussion

Growth and growth parameters

The genetic variability for days to 50% flowering (DTF) was varied from 77.33 (Jeeraphool) days to 99.00 (Rajgauhi, Karagi) days with an overall average of 89.27 days. The low values of GCV and PCV was found 4.84%, 8.24%, respectively. In respect to crop maturity days to maturity (DM) varied from 107.00 (Kansari) days to 131.67 (Karagi) days with an overall mean was 120.36 days. The low GCV and PCV was recorded 3.37%, 6.67%, respectively but for Plant height (PH) The low GCV and moderate PCV was recorded for the character were 8.82% and 11.85%. The

overall average plant height was found 106.92cm while, Bhalshankar showed lowest 80.40cm (Bhalshankar) and the highest significant was observed 128.30 cm (Kanga).

The Panicle length (PL) was recorded minimum value of 18.03 cm (Mansooriya) and a maximum of 31.63 cm (Sauthi) with an overall mean of 22.31 cm. The values of low GCV and moderate PCV was found for this character were 8.67%, 12.28%, respectively. In respect to Number of tillers per plant (NTPP) The high values of GCV and PCV was estimated for this trait were 21.37% and 24.23%, respectively. The number of tillers per plant varied from 5.46 (Malati) to 15.70 (Kanga) with an overall mean of 9.16.

Table 2: Estimation of variability, heritability and genetic advance for 11 characters of rice

Characters	Range		Mean	GCV %	PCV %	h ² (bs) %	GA as % mean
	Min	Max					
DTF	77.333	99.000	89.297	4.848	8.244	34.578	5.872
DTM	107.000	131.670	120.368	3.375	6.673	25.578	3.516
PH	80.400	128.300	106.923	8.820	11.854	55.358	13.518
PL	18.033	31.633	22.313	8.673	12.286	49.830	12.611
NTPP	5.467	15.700	9.162	21.375	24.233	77.804	38.839
NPTTP	4.733	14.533	7.962	22.885	26.520	74.468	40.682
NGPP	31.467	162.03	75.580	32.019	33.670	90.434	62.726
100-GW	1.367	3.267	2.270	13.643	18.304	55.551	20.947
BYPP	12.400	69.400	27.053	29.686	32.214	84.920	56.354
HI	18.133	51.267	30.168	16.393	22.189	54.583	24.949
GYPP	3.1667	28.500	8.421	48.449	50.037	93.754	96.638

Yield and yield parameters

The Number of productive tillers per plant (PTPP) was varied from 4.73 (Malti) to 14.53 (Kanga) with an overall mean of 7.96. The high values of GCV and PCV was recorded 22.88% and 26.52% in respect to Number of grain per panicle (NGPP), the minimum number of grains per panicle was recorded in the genotype Bhejari (31.46) and maximum number of grains per panicle was recorded in the genotype Bilailuchai (162.03) with a mean value of 75.58. The high GCV and PCV values for this character were recorded 32.01% and 33.67, respectively and Range of variation found for 100 grain weight (SI) was 1.36 (Badki Luchai) to 3.26 (Karanphool) with an overall mean value of 2.27. The moderate GCV and PCV was recorded 13.64%, 18.30%, respectively. The minimum biological yield per plant (BYPP) was recorded in germplasm Malati 12.40 g to maximum in LC-964 with value of 69.40 g and an overall mean value of 27.05 g. The high values of GCV and PCV was recorded are 29.68% and 32.21%, respectively and the Harvest index (HI) was recorded with minimum value of 18.13% (Pilcorneva) and a maximum value of 51.267% (MTU-1010) with a mean value of 39.72%. The moderate GCV and high PCV was found for the character were 16.39%, and 22.18%, respectively and in respect to Grain yield per plant (GYPP) The high values of GCV and PCV was recorded 48.44% and 50.03%, respectively. The grain yield per plant was found minimum in Malati with value of 3.16 g and maximum in MTU-1010 with value of 28.50 g and an overall mean of was recorded 8.42 g.

High values of GCV and PCV were recorded for grain yield per plant, biological yield per plant, number of tillers per plant, number of grains per panicle and number of tillers per plant. The above result's are agreement with findings of Devi *et al.* (2016) ^[2] for grain yield per plant, number of tillers per plant. Moderate GCV and high PCV recorded for harvest index. Similar findings were also reported by Srujana *et al.* (2017). Moderate GCV and moderate PCV were observed for 100 grain weight. This results werer also supported by Chowdhary *et al.* (2016). Low values of GCV and PCV were recorded for plant height, panicle length, days to 50% flowering and days to maturity. The above findings are agreement with Devi *et al.* (2016) ^[2] for panicle length, Samera *et al.* (2015) for days to 50% flowering and Singh *et al.* (2010) ^[4] for days to maturity.

Conclusion

The analysis of variance revealed that highly significant differences were recorded among the genotypes for all the characters. It indicated the presence of sufficient amount of genetic variability in the studied material for all the traits.

The study of the mean data the genotypes MTU-1010 (28.50g), LC-964 (27.80g), LC-767, Kalajeera (13.60g), Kanga (13.06g) and Sairi (12.13g) are identified as higher yielders.

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