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VARIABILITY IN SIMILAR NAMED JIRASAIL GROUP OF RICE GERMPLASM OF BANGLADESH

M S Ahmed[1], Shahnaz Parveen[2]

[1]Genetic Resources and Seed Division (GRSD), Bangladesh Rice Research Institute (BRRI), Gazipur-1701, Bangladesh.

[2]Training Division (TD), Bangladesh Rice Research Institute (BRRI), Gazipur-1701, Bangladesh

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ABSTRACT

Fifteen duplicate and similar named Jirasail group of rice germplasms were studied to evaluate the variations for 14 yield and yield contributing characters at Bangladesh Rice Research Institute during Boro 2019-20 season. The height leaf length (50 cm) was observed in Jira Bhog (Bolder) (acc. no. 4828) with a range of 25.6-50. The height culm diameter (4.7 mm) was recorded from JS15 (NC). The highest panicle length (32.8 cm) was observed in acc. 1984 (Jira Buti) with a range of 20.8-32.8. Jira Dhan (acc. 5313) had the longest plant height (124.8 cm) with a range of 84.8-124.8. Jira Dhan (acc. 5313) had the highest number of filled grains per panicle (251) with range 76-251. The longest dehulled grain (6.8 mm) and the highest LB ration (3.82) were found in acc. 6718 (Jirasail). The highest 1000-grain weight (21.8 g) was observed in Jirasail (Indian)(acc. 8056) and the lowest (8.9) in Jira Bhog (Finer)(acc. 4831). The highest grain yield (35.4 g/hill) was observed in Jirasail (Indian)(acc. 8056). Grain yield had highly significant positive correlation with leaf width, grain length, decorticated grain(s)length breadth ratio and 1000-grain weight, but highly significant negative correlation with panicle length and un-filled grain per panicle. Considerable genetic variations were observed among the Jirasails though have the similar or duplicate name. The best genotypes are acc. no. 1984, 4828, 4831, 5313, 6694, 6718, 8056 and NC (JS15). Finally, the potential genotypes with valuable gene(s) need to be conserved and utilized for Jirasail rice improvement.

Key word: Agronomic traits, Bangladesh, D2-statistics, Jirasail, rice, similar named.

1. INTRODUCTION

Rice yield per unit area as well as total rice production are required to increase along with the less land to meet the food demand of the increasing population of the country. Consequently, there is a necessity for developing AEZ (Agro Ecological Zone) based more high yielding climate smart varieties along with higher biomass production, good grain quality, high nutrition, medicinal values etc.Because, to feed the growing population, the global food supply will need to increase by nearly 70% by 2050 (Tian et al., 2006). Moreover, climate change is expected to have an impact on ensuring long-term food security, particularly in South Asia, where cereal yields are expected to drop by up to 30% by 2050 (IPCC, 2007).On the other hand, agro-morphological characterization of the germplasms is fundamental in order to provide information for plant breeding programmes (Das and Ghosh, 2011).

The plant genetic resources are reservoirs of natural genetic variation and provide raw material for crop improvement programs (Sharmaet al., 2013). It is a rich reservoir of valuable genes that plant breeders can harness for crop improvement (Yadav et al., 2013). To assess phenotypic variation, morphological and yield related features have been used as criteria as well as sources of enhancing the rice yield potential (Ali et al., 2024). Moreover, identifying germplasm accessions for different agronomical characters in phenotypically divergent sources would help in pre-breeding and breeding programs (Pachauri et al.,2017). Moreover, landraces and wild species possess immense potential of most valuable genes which can be effectively utilized in the present day breeding programmes to evolve miracle varieties in rice that possess not high yield potential and quality, but also resistant to biotic and abiotic stresses (Saxena et al., 1988) and the breeding programme requires much genetic variation for crop improvement (Rao et al., 2021).Therefore, characterization of rice germplasms increases its utilization.

Only a small proportion of the world rice germplasm collections have been used in breeding programmes though with abundance of genetic variability and diversity. Lack of access to phenotype information is still seen as a limiting factor for the use of plant genetic resources (Emiet al., 2021). Information generated from phenotyping the germplasms can be used as baseline information for utilization in rice breeding programmes (Rabara et al., 2014). Some of these genotypes are being gradually eroded from their respective places of origin and are on the verge of becoming extinct due to competition from high yielding varieties (Maxted and Kell, 2009). Therefore, characterization of rice germplasm is important both for crop protection aspects and as well as its improvement.However, Hamid et al. (1982) reported that duplicate(s) named as well as with many slightly deviated names rice germplasm given by the farmers,were cultivated all over Bangladesh-which need to be studied. Pachauri et al. (2017) also characterized 124 rice germplasm accessions including 119 germplasm received from NBPGR New Delhi on the basis of 19qualitative agro-morphological and 11 agronomical traits. Singhet al. (2021) evaluated 50 indigenous rice germplasm to estimate the Agro-morphological characterization of indigenous germplasm accessions of rice (Oryza sativa L.) in yield and yield contributing characters at Research cum Instructional Farm, Genetics and Plant Breeding Department, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, during Kharif 2018.Sarif et al. (2020) evaluated the genetic variability and diversity of 32 coloured rice accessions using 13 yield and yield contributing characteristics. Islam et al. (2018) studied 36 similar named aromatic rice landraces of Bangladesh on 14 quantitative characters. Consequently, more detailed studies on similar named groups of rice germplasm of Bangladesh need to be done for its more effective utilization.

2. OBJECTIVES OF THE STUDY

The present study was undertaken to characterize the duplicate and similar named Jirasail group of rice germplasm of Bangladesh through quantitative characters. The purpose of this study includes, the assessment of the variability of the quantitative traits.The determination of the extent of variability of the quantitative traits. The evaluation of the correlation among the quantitative traits. The identification of the potential genotypes of the duplicate and similar named Jirasail group of rice germplasm of Bangladesh. Finally, the study will facilitate the use of diverse germplasm in future breeding programmes.

3. MATERIALS AND METHODS

3.1 Materials of the study

A total of eleven accessions and four new collections (NC) of duplicate and similar named Jirasail group of rice germplasms received from Bangladesh Rice Research Institute (BRRI) Genebank (Table 1) were grown during Boro 2019-20 season for studying their quantitative and qualitative Agro-morphological diversity.

Table 1: List of similar and duplicate named Jirasail group of rice germplasmsgrown in Boro 2019-20 season

Sl. No.	Code	Acc. no.*	Name	Upazila	District	Collection year	Season
1	JS1	7591	Jira Sail	Sadar	Dinajpur	-	B. Amon
2	JS2	5061	Jira Shail	--	Dinajpur	2001	Aman
3	JS3	6694	Jirasail	Fulbari	Dinajpur	-	T. Aman
4	JS4	6718	Jirasail	Mahadevpur	Naogaon	-	T. Aman
5	JS5	8056	Jirasail (Indian)	Mohadevpur	Naogaon	2014	Boro
6	JS6	4828	Jira Bhog (Bolder)	Chirrbanoar	Dinajpur	1997	T. Amon
7	JS7	4831	Jira Bhog (Finer)	Chirrbanoar	Dinajpur	1997	T. Amon
8	JS8	1984	Jira Buti	Sribordi	Mymensingh	1977	T. Amon
9	JS9	5313	Jira Dhan	Dumuria	Khulna	2004	T. Aman
10	JS10	5045	Jira Katari	--	Dinajpur	2001	Aman
11	JS11	5975	Gira Katari	Dinajpur	Dinajpur	2005	T. Aman
12	JS12	NC**	Jira	--	Bogura	2018	T. Aman
13	JS13	NC	Jirasail	--	Jashore	2018	T. Aman
14	JS14	NC	Jirasail	--	Rajshahi	2018	T. Aman
15	JS15	NC	Jirasail	Modhupur (BADC)	Tangail	2018	T. Aman

*BRRI Genebank accession number, **New collection.

3.2 Plot layout and seedling transplanting of the experiment

The unit plot comprised with three rows of each 5.4 m long. The thirty-days-old single seedling was transplanted with a spacing of 20 × 20 cm between rows and plants, respectively.

3.3 Cultural management of the experiment

Fertilizers were applied @ 80:20:40:12 kg N, P, K and S per hectare respectively. Crop management such as weeding, irrigation etc. were done in time. Appropriate control measures were taken for insect pests, diseases and weeds when necessary.

3.4 Data recording and data analysis of the experiment

The germplasms were characterized through 14 quantitative characters at Genetic Resources and Seed Division of BRRI in Gazipur.The observed 14 quantitative Agronomical characters were seedling height (cm), leaf length (cm), leaf width (cm), culm diameter (mm), effective tiller number, panicle length (cm), plant height (cm), days to maturity, filled grains per panicle, un-filled grains per panicle, grain length (mm), decorticated grain length breadth ratio, 1000-grain weight (g) and grain yield per hill (g). The data were analyses by MSTATE-C programme.

4. RESULTS AND DISCUSSION

The 14 qualitative agro-morphological characters of 15 genotypes of duplicate and similar named Jirasail group of rice germplasms from BRRI Rice Genebank were studied during Boro 2019-21 season. The results of the assessment of variability of qualitative agro-morphological characters are described as follows:

4.1 Assessment of the Variability of the Quantitative Traits

The highest seedling height (12.8 cm) was observed in Jirasail (Indian) (acc. no. 8056) among the fifteen similar and duplicate named group of Jirasail germplasms (Table 2). The height leaf length (50 cm) was observed in Jira Bhog (Bolder) (acc. no. 4828) and the height leaf width (1.3 cm) was found in Jirasail (Acc. no..6694). The height culm diameter (4.7 mm) was recorded from Jirasail (NC). The highestnumber of effective tiller per hill (12) was observed in acc. no. 6694 (Jirasail). The highest panicle length (32.8 cm) was observed in acc. 1984 (Jira Buti) and the shortest panicle length (20.8) in acc. 4831 of Jira Bhog (Finer). Jira Dhan (acc. 5313) had the longest plant height (124.8 cm), while the shortest plant (84.8) was observed in NC (Jira). Jira Dhan (acc. 5313) had the highest number of filled grains per panicle (251) and the lowest (76) from Jirasail (acc. 6694) and Jira Katari (acc. 5045) had the highest number of un-filled grains per panicle (33) and the lowest (7) in Jirasail (acc. 6694) among the studied Jirasail germplasms. Besides, the longest dehulled grain (6.8 mm) and the highest LB ration (3.82) were found in acc. 6718 (Jirasail)(Figure 1). The highest 1000 grain weight (21.8 g) was observed in acc. 8056 of Jirasail (Indian) and the lowest (8.9) in acc. 4831 of Jira Bhog (Finer). Finally, the highest grain yield (35.4 g/hill) was observed in acc. 8056 of Jirasail (Indian) and the lowest (4.6 g/hill) in acc. 5061 (Jira Shail).

Table 2: Variability of 15 similar and duplicate named Jirasail group of rice germplasm for 14 important morphological characters during Boro 2019-20

Name	Acc. No.	SH (cm)	LL (cm)	LW (cm)	CD (mm)	ETN	PL (cm)	PH (cm)	DM (Days)	FGPP	UFGPP	GL (mm)	DGLBR	TGW (g)	GY (g/hill)
Jira Sail	7591	11.4	37.2	1.1	3.4	10	23.4	90.6	148	157	10	6.8	3.67	17.8	16.2
Jira Shail	5061	9.0	47.6	1.1	3.2	8	28.6	96.0	146	200	13	3.9	1.97	10.8	4.6
Jirasail	6694	12.0	35.6	1.3	3.5	12	23.6	106.0	151	76	7	5.7	2.33	19.8	18.6
Jirasail	6718	12.4	44.4	1.1	4.4	11	26.6	92.8	147	131	12	6.8	3.82	18.7	11.8
Jirasail (Indian)	8056	12.8	25.6	1.1	4.1	8	23.0	87.2	147	137	13	5.7	2.10	21.8	35.4
Jira Bhog (Bolder)	4828	9.8	50.0	1.0	3.6	9	24.0	117.0	149	83	10	4.4	2.25	14.7	12.9
Jira Bhog (Finer)	4831	10.0	40.4	1.0	4.0	8	20.8	104.4	146	120	9	3.7	1.70	8.9	10.7
Jira Buti	1984	10.6	44.0	0.7	4.3	9	32.8	120.4	147	91	13	4.7	2.34	12.9	5.9
Jira Dhan	5313	11.6	43.2	0.8	3.7	8	27.2	124.8	148	251	18	4.6	2.30	8.9	10.0
Jira Katari	5045	12.0	35.4	1.1	4.2	11	25.4	111.8	149	142	33	4.1	2.02	10.7	10.6
Gira Katari	5975	10.4	41.8	0.7	4.4	8	24.0	116.6	149	190	13	3.7	1.83	9.9	22.7

Jira	NC	12.0	35.6	0.8	4.2	8	23.0	91.2	146	142	15	5.8	3.05	13.9	11.7
Jirasail	NC	10.0	34.8	1.0	4.6	9	28.2	113.2	148	112	12	4.4	2.39	11.0	18.0
Jirasail	NC	10.0	39.0	1.2	3.8	8	23.4	90.2	146	193	11	6.4	3.51	18.6	20.5
Jirasail	NC	9.4	32.0	1.0	4.7	10	22.4	84.8	148	151	21	6.7	3.81	15.9	30.7
Min		9.0	25.6	0.7	3.2	8	20.8	84.8	146	76	7	3.7	1.70	8.9	4.6
Max		12.8	50.0	1.3	4.7	12	32.8	124.8	151	251	33	6.8	3.82	21.8	35.4
Mean		10.9	39.1	1.0	4.0	9	25.1	103.1	148	145	14	5.2	2.61	14.3	16.0
SE		0.31	1.63	0.05	0.13	0.36	0.80	3.49	0.36	12.39	1.63	0.31	0.21	1.11	2.22
CV		11.0	16.2	17.3	11.6	15.9	12.3	13.1	1.0	33.1	45.3	22.5	28.8	29.9	53.7
LSD		3.4	18.0	0.5	1.3	4.1	8.8	38.3	4.1	136.3	18.0	0.41	2.1	12.1	24.5

Legend: SH=Seedling height, LL=Leaf length, LW=Leaf width, CD=Culm diameter, ETN=Effective tiller number, PL=Panicle length, PH=Plant height, DM=Days to maturity, FGPP=Filled grain per panicle, UFGPP=Un-filled grain per panicle, GL=Grain length, DGLBR=Decorticated grain length breadth ratio, GB=Grain breadth, TGW=Thousand grain weight and GY=Grain yield.

Legend: All from left to right; 1st row contains JS1 to JS5, 2nd row contains JS6 to JS10 and 3rd row contains JS11 to JS15.

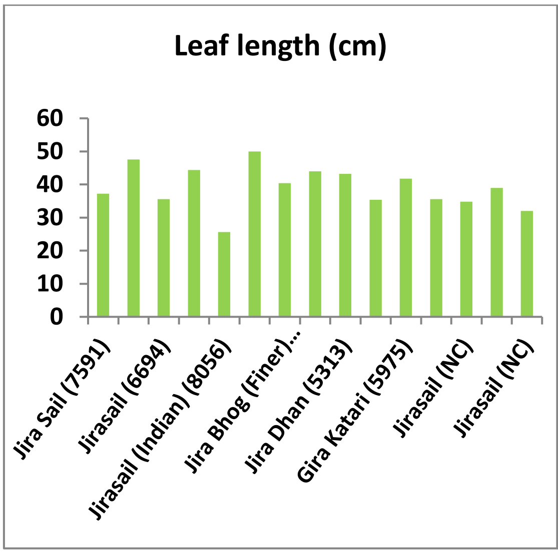
Figure 1: in grain morphology of similar and duplicate named Jirasail rice germplasm

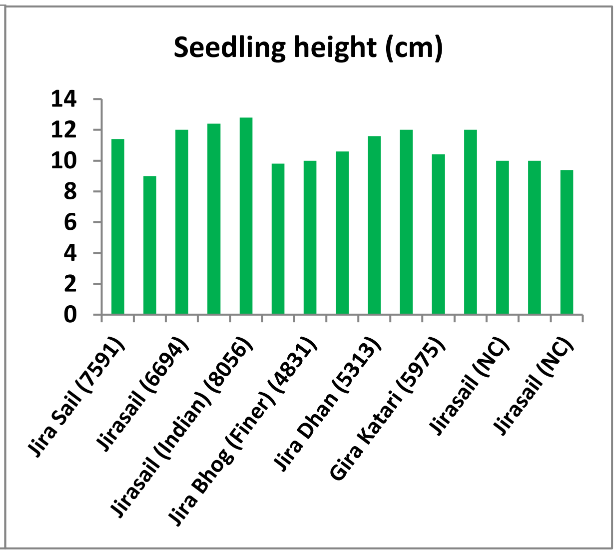
4.2 Determination of the Extent of Variability of the Quantitative Traits

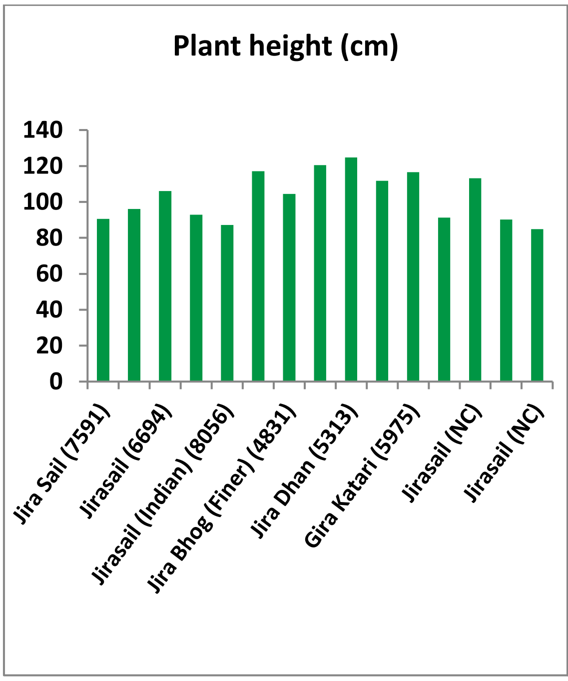
The mean value of seedling height (cm) was 10.9 with a range of 9-12.8 (Table 2 and Figure 2). The range of leaf length was 25.6-50 cm with a mean value of 39.1 cm and the mean value of leaf width (cm) was 1.0 with a range of 0.7-1.3. Similarly, the range of culm diameter was 3.2-4.7 mm with a mean value of 4.0 mm. The mean value of effective tiller number was 9 with a range of 8-12. Similarly, the mean of panicle length was 25.1 cm with a range of 20.8-32.8 and the mean of plant height was 103.1 cm with a range of 84.8-124.8 cm. The mean of days to maturity was 148 days with a range of 146-151. The range of filled grain per panicle was 76-251 with a mean of 145 and the mean value of un-filled grain per panicle was 14 with a range of 7-33. Similarly, the range of grain length was 3.7-6.8 mm with a mean of 5.2 mm and the mean value of decorticated grain length breadth ratio was 2.61 with a range of 1.70-3.82. Again, the mean of thousand grain weight was 14.3 g with a range of 8.9-21.8 g. Finally, the range of grain yield (g/hill) was 4.6-35.4 g with a mean value of 16 g. Therefore, similar and duplicate named Jirasail rice germplasms are not duplicated and need to be conserved in Genebank.Ahmed et al. (2008), Rahman et al. (2015), Ahmed et al. (2018), Pachauri et al. (2017), Chowdhury et al. (2018), Emiet al. (2021), Guptaet al. (2023) and Ali et al. (2024) also found valuable and highly significant variability among their studied rice germplasms.

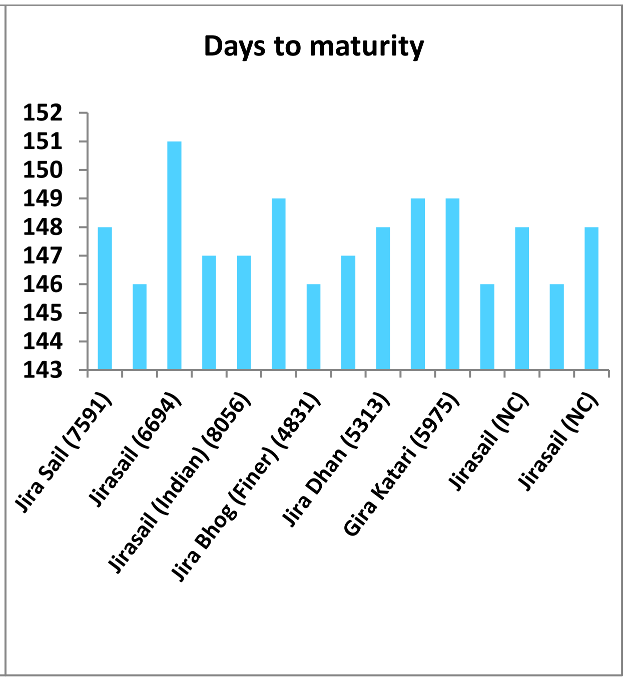
4.3 Evaluation of Simple Correlation among the Quantitative Traits

Simple correlation analysis among yield and yield contributing characters revealed that the yield had highly significant positive correlation with leaf width, grain length, decorticated grain length breadth ratio and 1000-grain weight, but highly significant negative correlation with panicle length and un-filled grain per panicle (Table 3). However, the 1000-grain weight had highly significant positive correlation with grain length and grain length breadth ratio, but negatively related with leaf length. The grain length breadth ratio had highly significant









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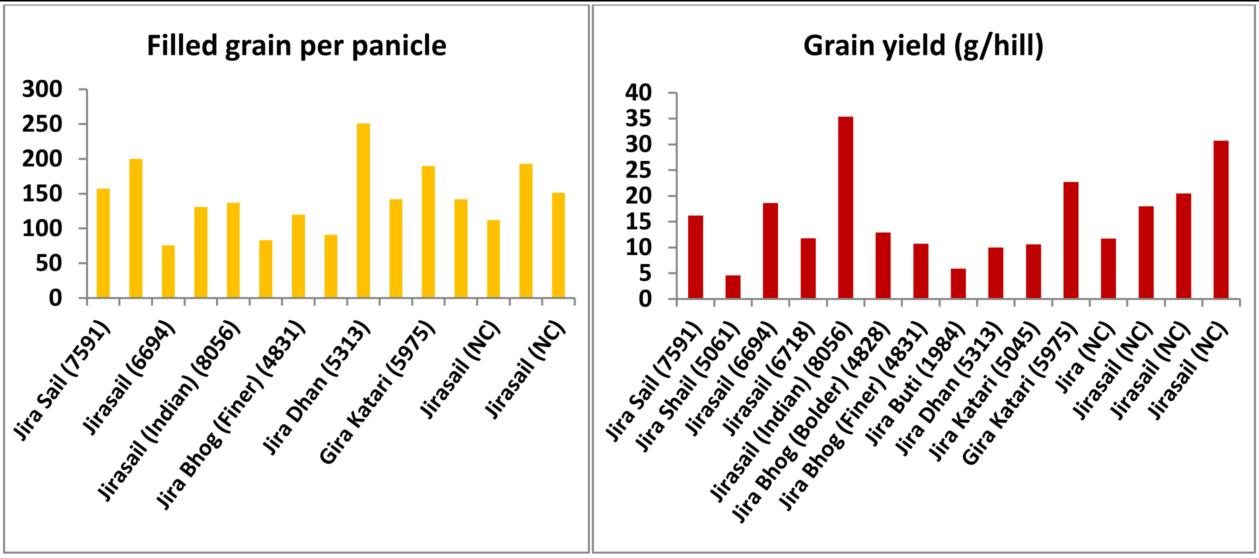

Figure 2: Variations of important agro-morphological characters among 15 similar or duplicate named Jirasail rice germplasm

Table 3: Correlation matrix of yield and yield contributing characters of 15 similar and or duplicate named Jirasail group of rice germplasm

Characters	SH	LL	LW	CD	ETN	PL	PH	DM	FGPP	UFGPP	GL	DG LBR	TGW	GY
SH	1.000													
LL	-0.268*	1.000												
LW	-0.008	-0.237	1.000											
CD	0.013	-0.380**	-0.257	1.000										
ETN	0.263*	-0.112	0.431**	0.076	1.000									
PL	-0.033	0.395**	-0.374**	0.018	-0.020	1.000								
PH	0.256	-0.185	0.331*	0.320*	0.959**	0.011	1.000							
DM	0.169	-0.040	0.261*	-0.038	0.605**	-0.054	0.562**	1.000						
FGPP	-0.067	0.084	-0.287*	-0.173	-0.424**	0.012	-0.423**	-0.264*	1.000					
UFGPP	0.093	-0.232	-0.158	0.309*	0.119	0.071	0.200	0.038	0.258	1.000				
GL	0.234	-0.380**	0.351*	0.148	0.354*	-0.298*	0.369*	-0.086	-0.145	-0.120	1.000			
DG LBR	0.104*	-0.135**	0.171**	0.107	0.291*	-0.164*	0.291*	-0.156	0.067*	-0.031*	0.875**	1.000		
TGW	0.327	-0.386	0.517	-0.129	0.313*	-0.289	0.269*	0.085	-0.314	-0.323	0.817**	0.545**	1.000	
GY	0.060	-0.199	0.418**	-0.118	0.206	-0.430**	0.155	-0.163	-0.016	-0.357*	0.900**	0.834**	0.732**	1.000

*, ** significant at 5%, 1% levels

positive correlation with leaf width, grain length, 1000-grain weight and grain yield,but highly significant negatively related with leaf length. The filled grain per panicle had highly significant negative correlation with effective tiller number and plant height, but un-filled grain per panicle had significant positive correlation with culm diameter. The days to maturity had highly significant positive correlation with effective tiller number and plant height, but negatively related with leaf length, culm diameter and panicle length. The plant height had highly significant positive correlation with effective tiller number, days to maturity, but highly significant negative relation with filled grain per panicle. The effective tiller number effective tiller number had highly significant positive correlation with leaf width, plant height and days to maturity,but highly significant negatively related with filled grain per panicle.Earlier Haque et. al. (1988),Das et. al. (1992), Iftekharuddaula et. al. (2001), Ahmed et al. (2008), Shresthaet al. (2018), Chowdhuryet al. (2018), Kayastha et al. (2022) and Saran et al. (2023) reported similar or comparable trend of results in rice.

5. CONCLUSION

Characterization is an important prerequisite to evaluate phenotypic diversity within the conserved germplasm. Evaluation of rice germplasm based on agronomicalcharacters revealed presence of substantial variability within the germplasm.Considerable ranges of genetic variations were observed among the studied 15 Jirasail germplasm for the 14 quantitative agronomical characters though have the similar or duplicate named.Based on yield performance and other relevant features, the best genotypes are JS3 (acc. no.6694), JS4 (6718), JS5 (8056), JS6 (4828), JS7 (4831),JS8 (1984), JS9 (5313) and JS15 (NC).Therefore, it can be said that studied Jirasail group of germplasm proposes a valuable gene pool, which needs to conserve in Genebank. However, the germplasm need to be further evaluated through SSR markers or SNP genotyping to generated more information for the selection, classification, conservation, identification of parental source and utilization for breeding programmes, such as marker-assisted selection (MAS) in Jirasail rice improvement. Finally, the identified core germplasm with potential gene(s) need to utilize in breeding programs, if possible. This study would be useful for breeders to choose and identify the revival and beneficial genes for rice improvement.

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