Original Research Article

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Characterization of African Rice Germplasm for Morphological and Yield Attributing Traits

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ABSTRACT

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For the establishment of the distinctness among 31 accessions of *Oryza glaberrima*, eight morphological traits following Distinctness, Uniformity and Stability test (DUS) studied. Out of 31 accessions studied, two accessions viz., EC861804, EC861805 were found to be highly distinct as they possessed distinct traits namely purple split ligule, medium green leaves, erect flag leaf, presence of awn along with lodging tolerance indicating their usefulness as donors for crop improvement programmes. Analysis of variance revealed significant differences for all the characters studied. Phenotypic coefficient variation was higher than genotypic coefficient variation and magnitude of PCV and GCV was high for number of productive tillers and spikelets per panicle. High heritability coupled with high genetic advance was observed for days to 50 per cent flowering and number of spikelets per panicle which suggested the presence of high additive gene action which would respond to selection owing their high genetic variability and transmissibility.

Introduction

Rice (*Oryza sativa* L.) is the principal food grain crop in India and it is being cultivated in 43.9 million ha with total of production of 109.6 million tonnes (Indiastat, 2016-17). Since the release of semi dwarf rice varieties in 1960's in India and elsewhere, the genetic

gain of yield potentiality among widely cultivated semi dwarf rice varieties is stagnated due to narrow genetic base. Therefore, it is inevitable to broaden the genetic base of modern rice varieties by infusing genomic regions from related species of *Oryza*. *Oryza glaberrima*, endemic to Africa, is reported to have many useful traits

such as resistance to biotic, abiotic stresses (Fofana and Cloutier, 2008) along with early maturity. In addition, *O. glaberrima* is also a potential source of genes to enhance milling, cooking, eating qualities of *indica* rice. In India, *O. glaberrima* is used in limited extent for genetic improvement of *indica* rice as very less systematic efforts have been undertaken in India to utilize the wealth of African species for genetic improvement of *indica* rice varieties (Sarla and Swamy, 2005).

Characterization of a variety is useful to identify and avoid duplication, enabling rice breeders to exploit a wide range of genotypic diversities for further crop improvement practices to increase the rice productivity. Generally, the morphological traits are qualitative in nature and are stable over generations (Raut, 2003), making them more reliable as morphological markers for the characterization of varieties. Development of high yielding cultivars with wide adaptability is the ultimate aim of plant breeders. Knowledge of genetic variability present in a given crop species for the character under improvement is of paramount importance for the success of any plant breeding program for broadening the gene pool of crops (Ahmad *et al.*, 2011). Heritability provides information on the extent to which a particular morphogenetic character can be transmitted to successive generations and also influences the choice of selection procedures used by the plant breeder to decide which selection methods would be most useful to improve the character (waqar *et al.*, 2008). Characters with high heritability can easily be fixed with simple selection, resulting in quick progress. However, it has been accentuated that heritability alone has no practical importance without genetic advance (Najeeb *et al.*, 2009). A systematic study analysis of genetic diversity is essential to exploit the inherent variability and to broaden the genetic base of rice cultivars (Rout *et al.*, 2017). Thus, the

present study was conducted to characterize understand the performance of African rice germplasm for eight morphological traits along with a study on genetic variability, heritability and genetic advance for grain yield and its component characters. The knowledge gained in the present study is will be useful for exploitation of genetic wealth of African rice for genetic improvement of Indian cultivars.

Materials and Methods

Thirty one *O. glaberrima* lines received from IRRI (International Rice Research Institute) were sown in dry bed during *Khari* 2017 at the ICAR-Indian Institute of Rice Research, Hyderabad. Twenty one days old seedlings of each accession were transplanted by adopting a spacing of 20 cm between rows and 15 cm between plants in a Randomized Block Design with two replications. Morphological characterization was carried out using eight DUS characters. Visual observations were recorded on single plant basis on five randomly selected plants in each accession at appropriate growth stages on eight qualitative characters *viz.*, Coleoptile colour, leaf intensity of green colour, culm type, leaf anthocyanin colouration, leaf ligule, flag leaf characteristics, panicle awn and stem anthocyanin colouration. Data was recorded on 10 quantitative characters namely, days to 50% flowering, plant height (cm), panicle length (cm), number of productive tillers, number of spikelets per panicle, 1000seed weight (g) and grain yield per plant (g), kernel length (mm), kernel breadth (mm) and L/B ratio. Replicated mean data of each character was subjected to analysis of variance following Panse and Sukatme (1985). Genotypic, phenotypic and environmental variance along with heritability and genetic advance were estimated for all the characters. The phenotypic (PCV) and genotypic (GCV) coefficients of variation, heritability (broad sense) and genetic advance were estimated by

the formulae suggested by Burton *et al.*, (1952) and Johnson *et al.*, (1955).

Results and Discussion

Among the eight qualitative characters studied in morphological characterization of the accessions (Table 1), three characters (Table 2) *viz.*, absence of coleoptile colour, leaf anthocyanin colouration and presence of leaf ligule were common in all the 31 accessions of *O. glaberrima*. Remaining five characters were unique and distinct among the accessions. The coleoptile was colourless in all the accessions of *O. glaberrima*. Regarding leaf characteristics, intensity of green colour in leaves was light in 18 accessions (58.06%) and medium green in the remaining 13 accessions. The anthocyanin colouration of leaves was absent in all the accessions of *O. glaberrima*, while all the 31 accessions of *O. glaberrima* had the leaf ligule with split shape in two accessions (EC 861804 and 861814 and acute in the remaining 29 accessions. The colour of ligule was also distinct across the accessions as it was white in 26 and purple in five accessions (EC861791, EC861796, EC861805, EC861819 and EC861817). With respect to the culm type, out of the 31 accessions of *O. glaberrima*, 27 accessions (87.09%) showed erect culm, one accession (EC861791) had semi erect culm, while spreading culm was observed in three accessions (EC861807, EC861812 and EC861813). The *O. glaberrima* accessions having erect type of culm can show lodging resistance. Regarding the attitude of the flag leaf blade, it was erect in six accessions (EC 861799, EC861804, EC861807, EC861810, EC861814 and EC861816), semi-erect in 19 and horizontal in the remaining six accessions (EC861792, EC861794, EC861797, EC861784, EC861811 and EC861815). The six accessions of *O. glaberrima* having erect flag leaf can serve as donor lines for improvement in rice breeding programmes.

For the panicle awn, nine accessions (EC861795, EC861799, EC861803, EC861812, EC861813, EC861814, EC861815, EC861817 and EC861818) recorded the presence of awn while it was absent in the remaining 22 accessions. With regard to the stem anthocyanin colouration, 13 accessions (41.93%) recorded the purple colouration while 18 accessions did not show anthocyanin colouration on stem. Two accessions *viz.*, EC861804, EC861805 were found to be highly distinct as they possessed distinct traits namely purple split ligule, medium green leaves, erect flag leaf, presence of awn along with lodging tolerance indicating their usefulness as donors for crop improvement programmes (Table 3).

Analysis of variance (Table 4) revealed significant differences among the accessions under study for all the ten traits indicating the presence of considerable genetic variability in the experimental material. A study of genetic parameters (Table 5) revealed that phenotypic and genotypic coefficients of variation were high for number of productive tillers per plant and spikelets per panicle. The values of GCV and PCV were moderate for days to 50 per cent flowering, plant height, productive tillers, 1000 seed weight, grain yield per plant and kernel length while low for panicle length, kernel breadth and L/B ratio. These results are in accordance with findings of Rusdiansyah *et al.*, (2017) for high GCV and PCV, Abebe *et al.*, (2017) for moderate GCV, PCV and Edukondalu *et al.*, (2017) for low GCV and PCV in rice (*O. sativa* L.). High heritability coupled with high genetic advance was observed for days to 50 per cent flowering, plant height and number of spikelets per panicle indicated the preponderance of high additive type of gene action in the inheritance of these characters which can be further improved by following simple selection procedure as suggested by Abebe *et al.*, (2017) (Fig. 1 and Table 6).

Table.1 List of *Oryza glaberrima* accessions used in the present study

S.No	Accession No.	Origin	Biological status of accession
1	EC861784	Guinea	Traditional cultivar/ Landrace
2	EC861785	Guinea	Traditional cultivar/ Landrace
3	EC861786	Guinea	Traditional cultivar/ Landrace
4	EC861787	Guinea	Traditional cultivar/ Landrace
5	EC861790	Guinea	Traditional cultivar/ Landrace
6	EC861791	Guinea	Traditional cultivar/ Landrace
7	EC861792	Guinea	Traditional cultivar/ Landrace
8	EC861794	Guinea	Traditional cultivar/ Landrace
9	EC861795	Guinea	Traditional cultivar/ Landrace
10	EC861796	Guinea	Traditional cultivar/ Landrace
11	EC861797	Guinea	Traditional cultivar/ Landrace
12	EC861799	Guinea	Traditional cultivar/ Landrace
13	EC861801	Guinea	Traditional cultivar/ Landrace
14	EC861802	Guinea	Traditional cultivar/ Landrace
15	EC861803	Guinea	Traditional cultivar/ Landrace
16	EC861804	Guinea	Traditional cultivar/ Landrace
17	EC861805	Guinea	Traditional cultivar/ Landrace
18	EC861807	Guinea	Traditional cultivar/ Landrace
19	EC861808	Guinea	Traditional cultivar/ Landrace
20	EC861809	Guinea	Traditional cultivar/ Landrace
21	EC861810	Guinea	Traditional cultivar/ Landrace
22	EC861811	Guinea	Traditional cultivar/ Landrace
23	EC861812	Guinea	Traditional cultivar/ Landrace
24	EC861813	Guinea	Traditional cultivar/ Landrace
25	EC861814	Guinea	Traditional cultivar/ Landrace
26	EC861815	Guinea	Traditional cultivar/ Landrace
27	EC861816	Guinea	Traditional cultivar/ Landrace
28	EC861817	Guinea	Traditional cultivar/ Landrace
29	EC861818	Guinea	Traditional cultivar/ Landrace
30	EC861819	Malaysia	Wild
31	EC861820	Malaysia	Wild

Table.2 Characterization of 31 accessions of *O. glaberrima* for morphological traits

S.NO.	Accession	Coleoptile colour	Intensity of green colour in leaves	Leaf anthocyanin colouration	Leaf ligule	Culm type	Flag leaf attitude	Panicle awn	Stem anthocyanin colouration
1	EC 861784	colourless	light	absent	present	erect	horizontal	absent	absent
2	EC 861785	colourless	light	absent	present	erect	semi erect	absent	absent
3	EC 861786	colourless	light	absent	present	erect	semi erect	absent	absent
4	EC 861787	colourless	medium	absent	present	erect	semi erect	absent	absent
5	EC 861790	colourless	medium	absent	present	erect	semi erect	absent	absent
6	EC 861791	colourless	medium	absent	present	semi erect	semi erect	absent	absent
7	EC 861792	colourless	light	absent	present	erect	horizontal	absent	absent
8	EC 861794	colourless	medium	absent	present	erect	horizontal	absent	present
9	EC 861795	colourless	light	absent	present	erect	semi erect	present	present
10	EC 861796	colourless	light	absent	present	erect	semi erect	absent	absent
11	EC 861797	colourless	light	absent	present	erect	horizontal	absent	absent
12	EC 861799	colourless	light	absent	present	erect	erect	present	present
13	EC 861801	colourless	medium	absent	present	erect	semi erect	absent	present
14	EC 861802	colourless	light	absent	present	erect	semi erect	absent	present
15	EC 861803	colourless	light	absent	present	erect	semi erect	present	present
16	EC 861804	colourless	medium	absent	present	erect	erect	absent	absent
17	EC 861805	colourless	medium	absent	present	erect	semi erect	absent	present
18	EC 861807	colourless	medium	absent	present	spreading	semi erect	absent	present
19	EC 861808	colourless	medium	absent	present	erect	semi erect	absent	absent
20	EC 861809	colourless	medium	absent	present	erect	semi erect	absent	present
21	EC 861810	colourless	light	absent	present	erect	erect	absent	absent
22	EC 861811	colourless	light	absent	present	erect	horizontal	absent	absent
23	EC 861812	colourless	medium	absent	present	spreading	semi erect	present	absent
24	EC 861813	colourless	light	absent	present	spreading	semi erect	present	present
25	EC 861814	colourless	light	absent	present	erect	erect	present	present
26	EC 861815	colourless	light	absent	present	erect	horizontal	present	absent
27	EC 861816	colourless	medium	absent	present	erect	erect	absent	absent
28	EC 861817	colourless	medium	absent	present	erect	semi erect	present	absent
29	EC 861818	colourless	light	absent	present	erect	semi erect	present	present
30	EC 861819	colourless	light	absent	present	erect	semi erect	absent	present
31	EC 861820	colourless	light	absent	present	erect	semi erect	absent	absent

Table.3 Frequency distribution of morphological traits in 31 accessions of *O. glaberrima*

S.No.	Character	Status	No. of accessions	Frequency	Accessions
1	Coleoptile colour	Colourless	31	100%	EC 861784, 861785, 861786, 861787, 861790, 861791, 861792, 861794, 861795, 861796, 861797, 861799, 861801, 861802, 861803, 861804, 861805, 861807, 861808, 861809, 861810, 861811, 861812, 861813, 861814, 861815, 861816, 861817, 861818, 861819, 861820
2	Intensity of green colour in leaves	Light	18	58.06%	EC 861784, 861785, 861786, 861792, 861795, 861796, 861797, 861799, 861802, 861803, 861810, 861811, 861813, 861814, 861815, 861818, 861819, 861820
		Medium	13	41.93%	EC 861787, 861790, 861791, 861794, 861801, 861804, 861805, 861807, 861808, 861809, 861812, 861816, 861817
3	Leaf anthocyanin colouration	Present	0	0%	-
		Absent	31	100%	EC 861784, 861785, 861786, 861787, 861790, 861791, 861792, 861794, 861795, 861796, 861797, 861799, 861801, 861802, 861803, 861804, 861805, 861807, 861808, 861809, 861810, 861811, 861812, 861813, 861814, 861815, 861816, 861817, 861818, 861819, 861820

S.No.	Character	Status	No. of accessions	Frequency	Accessions
4	Leaf ligule	Present	31	100%	EC 861784, 861785, 861786, 861787, 861790, 861791, 861792, 861794, 861795, 861796, 861797, 861799, 861801, 861802, 861803, 861804, 861805, 861807, 861808, 861809, 861810, 861811, 861812, 861813, 861814, 861815, 861816, 861817, 861818, 861819, 861820
		Absent	0	0%	-
5	Culm type	Erect	27	87.09%	EC 861784, 861785, 861786, 861787, 861790, 861792, 861795, 861796, 861797, 861799, 861801, 861802, 861803, 861804, 861805, 861808, 861810, 861811, 861814, 861815, 861816, 861817, 861818, 861819, 861820
		Semi erect	1	0.03%	EC 861791
		Spreading	3	0.09%	EC 861807, 861812, 861813
6	Flag leaf attitude	Erect	6	19.35%	EC 861799, 861804, 861807, 861810, 861814, 861816
		Semi erect	19	61.29%	EC 861785, 861786, 861787, 861790, 861791, 861795, 861796, 861801, 861802, 861803, 861805, 861808,
		Horizontal	6	19.35%	EC 861784, 86179, 861794, 86179, 861811, 861815
7	Panicle awn	Present	9	29.03%	EC 861795, 861799, 861803, 861812, 861813, 861814, 861815, 861817, 861818
		Absent	22	70.96%	EC 861784, 861785, 861786, 861787, 861790, 861791, 861792, 861794, 861796, 861797, 861801, 861802, 861804, 861805, 861807, 861808, 861809, 861811, 861810, 861816, 861819, 861820
8	Stem anthocyanin colouration	Present	13	41.93%	EC 861794, 861795, 861799, 861801, 861802, 861803, 861805, 861807, 861809, 861813, 861814, 861818, 861819
		Absent	18	58.06%	EC 861784, 861785, 861786, 861787, 861790, 861791, 861792, 861796, 861797, 861804, 861808, 861810, 861811, 861812, 861815, 861816, 861817, 861820

Table.4 Analysis of variance for yield and yield attributing traits in rice *Oryza glaberrima* accessions

S. No.	Character	Replication (d.f.=1)	Treatment (d.f.=30)	Error (d.f.=30)
1	Days to 50% flowering	41.30	283.00**	12.58
2	Plant height (cm)	0.16	476.159**	57.39
3	Number of productive tillers	1.19	36.29**	2.21
4	Panicle length (cm)	3.71	8.64**	3.63
5	No. of spikelets per panicle	71.85	2257.44**	279.08
6	1000 grain weight (g)	17.80	16.12**	5.06
7	Grain yield per plant (g)	1.45	3.54**	0.36
8	Kernel length (mm)	0.11	0.48**	0.18
9	Kernel breadth (mm)	0.03	0.09**	0.02
10	L/B ratio	0.01	0.13**	0.05
** Significant at 1% level * Significant at 5% level				

Table.5 Magnitude of variability, heritability and genetic advance for yield and yield attributing traits in *Oryza glaberrima* accessions

Characters	PCV (%)	GCV (%)	Heritability in broad sense(h^2)(%)	Genetic Advance (at 5%)
Days to 50% flowering	10.38	9.93	91.49	22.91
Plant height (cm)	12.32	10.92	78.49	26.41
No. of productive tillers per plant	34.38	32.35	88.51	8.00
Panicle length (cm)	9.33	6.35	40.84	2.08
No. of spikelets per panicle	29.98	26.48	77.99	57.22
1000 grain weight (g)	18.45	13.33	52.19	3.4
Grain yield per plant (g)	16.58	14.98	81.63	2.35
Kernel length (mm)	16.36	15.33	87.86	2.51
Kernel breadth (mm)	8.55	6.13	51.54	0.26
L/B ratio	10.34	7.00	45.86	0.28

Table.6 Mean performance of *O.glaberrima* accessions for yield and yield attributing traits

S.NO.	Accession	Days to 50% flowering	Plant height (cm)	Productive tillers	Panicle length (cm)	Spikelets/ Panicle	1000 seed weight (g)	Yield/ Plant (g)	Kernel length (mm)	Kernel breadth (mm)	L/B ratio
1	EC 861784	126.0	127.0	12.0	26.7	110.0	15.9	8.2	7.2	2.6	2.7
2	EC 861785	125.0	150.9	14.0	29.1	102.0	14.8	7.2	8.0	3.4	2.3
3	EC 861786	139.0	138.8	14.0	24.2	110.0	13.7	8.1	7.8	2.7	2.8
4	EC 861787	120.0	128.5	8.0	24.0	159.0	15.5	7.2	7.3	3.0	2.4
5	EC 861790	137.0	122.2	14.0	27.0	119.0	16.3	9.7	8.3	3.0	2.7
6	EC 861791	146.0	122.8	13.0	26.0	87.0	11.3	6.5	7.5	2.7	2.7
7	EC 861792	126.0	132.9	14.0	23.4	107.0	14.6	7.1	8.7	2.8	3.0
8	EC 861794	116.0	133.3	11.0	28.2	145.0	17.6	8.5	7.9	2.7	2.8
9	EC 861795	119.0	144.6	9.0	23.3	120.0	18.7	9.7	9.0	3.0	3.0
10	EC 861796	113.0	144.2	10.0	27.5	121.0	22.0	7.3	8.4	2.8	2.9
11	EC 861797	123.0	122.7	8.0	25.4	113.0	17.6	9.0	7.4	2.9	2.5
12	EC 861799	117.0	132.7	15.0	27.1	94.0	19.2	9.1	8.3	2.9	2.8
13	EC 861801	121.0	136.9	7.0	27.3	98.0	16.2	9.1	8.2	3.1	2.6
14	EC 861802	120.0	133.8	10.0	27.7	108.0	19.3	9.4	8.3	2.9	2.8
15	EC 861803	114.0	140.6	13.0	23.8	84.0	15.8	8.3	8.2	2.7	3.0
16	EC 861804	100.0	138.8	16.0	23.0	87.0	22.8	8.2	8.3	3.2	2.5
17	EC 861805	140.0	140.1	9.0	24.4	80.0	12.1	6.5	8.3	3.2	2.5
18	EC 861807	112.0	144.6	15.0	24.3	113.0	18.2	8.2	8.1	3.2	2.5
19	EC 861808	114.0	130.7	14.0	23.3	118.0	18.4	7.9	8.5	3.0	2.8
20	EC 861809	104.0	136.5	12.0	29.3	101.0	18.1	10.8	8.4	2.9	2.9
21	EC 861810	116.0	118.0	12.0	24.2	138.0	19.2	8.9	8.7	3.0	2.9
22	EC 861811	112.0	139.3	8.0	24.7	110.0	19.0	10.1	8.5	2.9	2.9
23	EC 861812	111.0	124.3	10.0	22.6	110.0	22.1	7.1	8.0	3.0	2.6
24	EC 861813	131.0	128.2	15.0	22.8	110.0	16.1	12.8	8.8	2.4	3.6
25	EC 861814	109.0	138.2	7.0	24.4	102.0	20.7	7.9	8.5	2.8	2.9
26	EC 861815	104.0	150.8	14.0	23.9	115.0	15.8	7.8	9.0	2.8	3.2
27	EC 861816	86.0	117.3	7.0	23.0	117.0	19.8	7.8	8.5	2.8	3.0
28	EC 861817	106.0	147.5	11.0	25.7	104.0	19.3	8.2	8.1	2.7	2.9
29	EC 861818	109.0	155.2	7.0	23.6	126.0	17.9	8.3	8.2	2.8	2.8
30	EC 861819	103.0	147.2	8.0	22.5	94.0	20.0	8.0	8.7	2.9	3.0
31	EC 861820	118.0	152.0	13.0	27.2	91.0	19.8	6.8	9.2	2.9	3.1

Fig.1 Bar graph for morphological characterization of 31 accessions of *O. glaberrima*

Plate.3 Variation in ligule colour and shape

Purple Ligule

Colourless Ligule

Acute Ligule

Split Ligule

Plate.4 Variation in culm attitude

Erect

Semi Erect

Spreading

Plate.5 Variation in attitude of flag leaf

Erect

Semi Erect

Horizontal

Plate.6a Variation in panicle awn

Short awned

Long awned

Awnless

Plate.6b Variation in stem anthocyanin colouration

Anthocyanin pigmentation on stem

Absence of Anthocyanin on stem

Plate.7 Variation in leaf intensity of green colour

Light Green

Medium Green

The high estimates of heritability coupled with low genetic advance for no. of productive tillers per plant, grain yield per plant, and kernel length indicated the presence of non-additive gene effects. In the present study, three superior accessions, viz., EC861785, EC861804 and EC861813 were found to be potential enough to be used as parents in various breeding programmes. These accessions recorded highest values for panicle length, productive tillers and grain yield per plant and hence their utilization in combination breeding may help in generating high yielding varieties by pyramiding all the favourable genes and keeping in view of the facts, much attention needs to be given for the components with high GCV, PCV and high heritability coupled with high genetic advance during selection for the further improvement of the remaining accessions.

In conclusion, among the eight morphological traits studied in the 31 accessions of *O. glaberrima*, three characters viz., absence of coleoptile colour, absence of leaf anthocyanin colouration and presence of leaf ligule were reported in all the 31 accessions. Remaining

five characters were unique and distinct among the accessions. Out of 31 accessions of *O. glaberrima*, two accessions viz., EC 861804, EC 861805 were found to be highly distinct as they possessed distinct traits namely purple split ligule, medium green leaves, erect flag leaf, presence of awn along with lodging tolerance. Adequate genetic variability in the 31 accessions of *O. glaberrima* was observed.

The magnitude of PCV and GCV was high for number of productive tillers per plant, while high heritability coupled with high genetic advance was observed for days to 50 per cent flowering and number of spikelets per panicle. The accessions EC861785, EC861804 and EC861813 can be used as parental material in future rice breeding programme as they have recorded highest values for the important yield traits viz., for panicle length, productive tillers and grain yield per plant. The present study revealed sufficient genetic variability for yield related traits which could be exploited for genetic improvement of rice cultivars (*Oryza sativa* L).

References

- Abebe, T., Alamerew, S and Tulu, L. 2017. Genetic variability, heritability and genetic advance for yield and its related traits in rainfed lowland rice (*Oryza sativa* L.) genotypes at Fogera and Pawe, Ethiopia. *Advanced Crop Science and Technology*.5: 272.
- Ahmad.,Qayyum., Sahibzada., Saleem., Ghaffar., Mehnaz and Farhad. 2011. Genetic diversity analysis for yield and other parameters in maize (*Zea mays* L.) genotypes. *Asian Journal of Agricultural Sciences*. 3.
- Burton, G.W and DeVane, E.H. 1952. Estimating heritability in tall fescue (*Festuca arundinacea*) from replicated clonal material. *Agronomy Journal*. 19: 45.
- Edukondalu, B., Ram Reddy, V., Shobha Rani, T., ArunaKumari, Ch and Soundharya, B. 2017. Studies on variability, heritability, correlation and path analysis for yield, yield attributes in rice (*Oryza sativa* L.).*International Journal of Current Microbiology and Applied Sciences*.6 (10): 2369-2376.
- Fonfana, B and Cloutier, S. 2008. Assesment of molecular diversity with QTLs for preharvest sprouting resistance in wheat using microsatellite markers. *Genome*. 51: 375-386.
- Indiastat.Agriculture Production Statistical Database.2016-17. <http://www.indiastat.com>.
- Johnson, H.W., Robinson, H.F and Comstock, R.E. 1955. Estimation of genetic and environmental variability in soybean. *Agronomy Journal*. 47: 314–318.
- Najeeb, S., Rather, A.G., Parray, G.A., Sheikh, F.A and Razvi, S.M. 2009.Studies on genetic variability, genotypic correlation and path coefficient analysis in maize under high altitude temperate ecology of Kashmir. *Maize Genetics Cooperation Newsletter*. 83: 1- 8.
- Pansee, V.G and Sukhatme, P.V. 1985. *Statistical methods for Agriculture workers*. Indian council of Agricultural research Publication. 87-89.
- Raut, V.M. 2003. Qualitative genetics of Soyabean. *Soybean Research*. 1:1-28.
- Rout B., Sridhar M., Muralidhara, B., Kamal Nath Reddy, KR., Sundaram R.M., Anantha M.S., Senguttuvel, P., SubbaRao, L.V, Padmavathi, G., Ranganath, H.K., Fiyaz, A.R., Jyothi, B., Suvarna Rani, C., Kalyani, M.B., Bidyasagar Mandal and Gireesh, C. 2017. Characterization of genetic diversity among wild rice accessions using genome specific In-Del markers. *Journal of Rice Research*.10 (2): 11-17.
- Rusdiansyah, M., Subiono, T., Sunaryo, W., Suryadi, A., Sulastri, G and Anjasmara, S. 2017.The genetic diversity and agronomical characters of local cultivars of tidal rice in East Kalimantan, Indonesia. *Biodiversitas*. 18:1289-1293.
- Sarla, N and Swamy, B.P.M. 2005.*Oryza glaberrima*: A source for improving *Oryza sativa*. *Current science*. 89 (6): 955-963.
- Waqar, M.F., Malik., Rashid, M., Munir, M and Akram, Z. 2008. Evaluation and estimation of heritability and genetic advancement for yield related attributes in wheat lines. *Pakistan Journal of Botany*. 40 (4):1699-1702.

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