International Journal of Agriculture Sciences
ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 7, Issue 8, 2015, pp.-606-609.
Available online at http://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

GENETICAL ASSESSMENT OF BIOCHEMICAL TRAITS IN MEDICINAL LAND RACES OF RICE (*ORYZA SATIVA* L.)

SUVARNA RANI CHIMMILI*, USHA KUMARI R., GNANAMALAR R.P., PREMKUMAR R. AND SUBASHINI G.
Department of rice, Centre for Plant Breeding & Genetics Tamil Nadu Agricultural University – 641003
* Correspondence Author, Email: suvarna.1412@gmail.com

Received: July 13, 2015; Revised: August 14, 2015; Accepted: August 14, 2015

Abstract- An investigation was carried out in the Department of Plant Breeding and Genetics at Agricultural College and Research Institute, Madurai with 13 parents and 40 hybrids of rice which were effected through Line x Tester mating design. Seven high yielding released varieties of Tamil Nadu viz., MDU 5, ADT 36, ADT 43, ADT 45, TPS 4, ASD 16 and one IRRI variety IR 72 were used as lines. Five medicinal landraces of rice collected from different areas of Kerala and Tamil Nadu viz., Navara, Chennellu, Kavuni, Veeradangan and Kathanellu were used as testers. Based on per se performance of single plant yield and number of productive tillers per plant, 12 hybrids were selected and analysed for six biochemical parameters viz., carbohydrate, protein, iron, zinc, calcium and magnesium contents along with their parents. The GCV and PCV (genotypic coefficient of variance and phenotypic coefficient of variance) were high for all the traits except for carbohydrate content. High heritability with high genetic advance was exhibited by all the nutritive traits while moderate genetic advance was exhibited by protein content.

Keywords: Rice, Medicinal land races, biochemical traits, PCV, GCV

Citation: Suvarna Rani Chimmili, et al. (2015) Genetical Assessment of Biochemical Traits in Medicinal Land Races of Rice (*Oryza Sativa* L.), International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 7, Issue 8, pp.-606 – 609. .

Introduction

In several Asian countries, rice provides 50 to 80 percent of the energy intake of the poor. A major challenge of our time is that one sixth of the world's population suffers from hunger. In addition, many more people, over half of the global population, are afflicted by a different form of food deficiency. This "hidden hunger" is due to the quality, rather than the quantity, of the food available, and it is closely related to the fact that in many poor developing countries people rely only or mostly on low-protein staple crops for food like rice. Conventional strategies to combat nutrient deficiencies include dietary supplements and food fortification programs. India which has been endowed with more than two lakhs rice varieties a rich biodiversity [8]. Until recently, rice was considered only a starchy food and a source of carbohydrates and some amount of protein. Recent studies have unraveled a number of unknown properties of rice, some of which have been reported in ancient Indian Ayurvedic literature . The coloured rice (black and red) are rich in minerals (iron and zinc). In the present investigation these landraces were evaluated with high yielding varieties along with the selected crossbreed hybrids.

Material and method

The crossbreed programme have been effected through Line X Tester mating design involving 13 genotypes, among them five were medicinal landraces from Tamil Nadu and Kerala. Kavuni (from Chettinadu, Tamil Nadu), Veeradangan and Kathanellu (from southern districts of Tamil Nadu), Njavara and Chennallu (from Kerala) were taken as male parents which were evaluated and crossed along with eight cultivated released high yielding varieties (MDU 5, ADT 36, ADT 39, ADT 43, ADT 45, TPS 4, ASD 16, IR 72) of Tamil Nadu for genetic variability of biochemical traits. Twelve hybrids were subjected for nutritive analysis based on per se performance of single plant yield and number of productive tillers per plant. They were raised in randomized block design with 3 replications at spacing of 20cm x 15cm. Each genotype was sown in a plot of four rows of 3.0m length. Recommended agronomic practices and plant protection measures were followed to raise a good crop. The data were recorded on six characters viz., carbohydrate, protein, iron, zinc, calcium, magnesium contents along with their parents. The samples were prepared and total carbohydrate was done by Anthrone method [5], protein content by lowry method [6], calcium and magnesium content was estimated by Versenate method and iron and zinc content was read by Atomic Absorption Spectrophotometer (GBC Avanta ver.2.02).

$$\text{Calcium content (mg / 100 g)} = \frac{0.0004 \times \text{Titre value}}{\text{Volume of extract (ml)}} \times 100 \times 100 \times 1000$$

$$\text{Mg content (mg /100 g)} = \frac{0.00024 \times (\text{Titre value of Mg} - \text{Titre value of Ca})}{\text{Volume of extract (ml)}} \times 100 \times 100 \times 1000$$

Results and Discussion

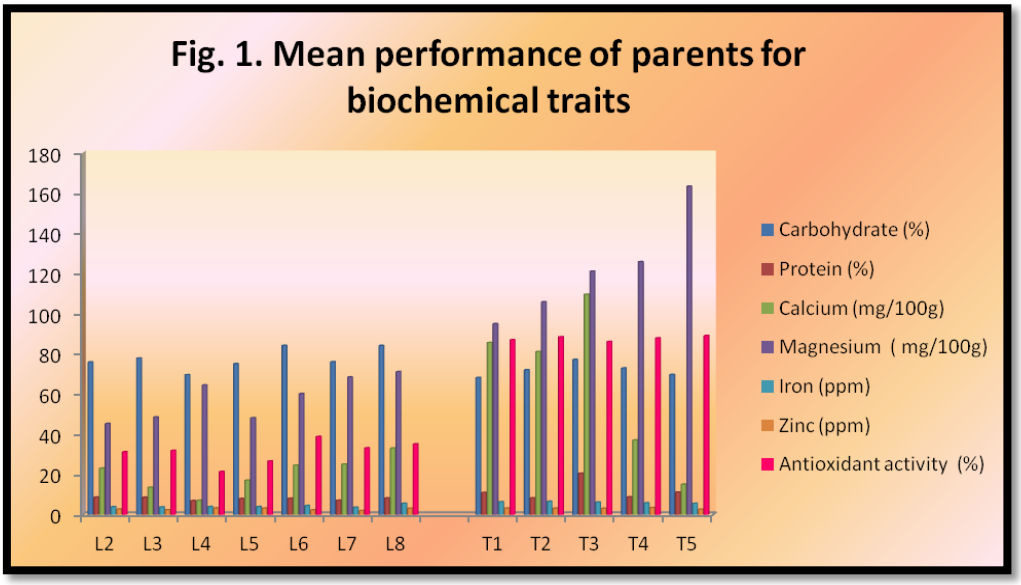
Rice is the dominant cereal crop in most Asian countries and is the staple food for more than half of the world's population. Besides the food security, under nutrition and malnutrition is the raising problem in the developing countries. As Rice being a staple food, even a small increase in nutritive content in rice would have a significant impact on human health. Conventional biofortification (breeding staple food crops with high nutritive content) of cultivated varieties using nutritive rich landraces of rice can serve the purpose. Biofortification is likely to reach rural households especially subsistence farmers who grow and consume the harvested cereal grains which in turn are expected to have impact in an affordable and sustainable manner.

While choosing the parents, high mean value of nutritive traits was considered as

main criterion among the breeders for a long time. Parents with good per se performance will yield better hybrids in most occasions. The per se of parents is an indication of performance of their progenies in advance generations [3]. Among the lines, ADT 36, ASD 16 and IR 72 recorded significantly higher mean values for single plant yield [Table-1], [Fig-1]. Among the three, ADT 36 exhibited significant mean performance for carbohydrate content, protein content and zinc content. All the testers had significant mean values for biochemical traits viz., protein, calcium, magnesium, iron and zinc contents except for carbohydrate content. Kavuni had higher carbohydrates, protein and calcium while Navara had significant amounts of iron, zinc and calcium. Veeradangan had higher magnesium and zinc contents. Kathanellu had higher levels of magnesium. From the twelve hybrids ASD 16 x Veeradangan and IR 72 x Veeradangan had significant levels of carbohydrates, iron and magnesium. In addition, ASD 16 x Veeradangan found to be the best for calcium content. Significant iron content was recorded by ADT 36 x Navara, ADT43 x Chennellu, ADT43 x Kavuni, ADT 45 x Chennellu and ADT 45 x Kavuni.

Table-1 *Mean performance of parents and selected hybrids for nutritive traits*

Genotypes	Carbohydrate (%)	Protein (%)	Calcium (mg/100g)	Magnesium (mg/100g)	Iron (ppm)	Zinc (ppm)
L_1	70.46	7.58	33.00	59.26	3.52	3.05*
L_2	75.84*	8.59*	23.00	45.22	3.83	2.68*
L_3	77.73*	8.56*	13.50	48.44	3.69	2.31
L_4	69.51	6.87	7.00	64.38	3.91	3.25*
L_5	75.02*	7.93*	17.00	48.08	3.91	3.14*
L_6	84.10*	8.03*	24.50	60.12	4.42	2.23
L_7	75.95	7.06	25.00	68.38	3.59	1.92
L_8	84.04*	8.17	33.00	71.06	5.53*	3.04*
T_1	68.08	10.89*	85.50*	84.88*	6.30*	3.19*
T_2	71.97	8.25*	81.00*	105.73*	6.52*	3.11*
T_3	77.06*	20.46*	109.50*	120.98*	6.11*	3.04*
T_4	72.84	8.72*	37.00*	125.73*	5.80*	3.39*
T_5	69.63	11.08*	15.00	163.30*	5.50*	2.58*
$L_1 \times T_1$	60.34	6.56	21.00	37.82	2.64	1.41
$L_2 \times T_1$	67.91	5.50	41.00	72.54	6.70*	1.52
$L_3 \times T_3$	62.98	5.41	25.00	102.09*	4.42	0.72
$L_3 \times T_4$	57.34	5.22	28.50	64.92	4.73	1.75
$L_4 \times T_2$	68.11	4.45	22.00	110.98	5.41*	1.37
$L_4 \times T_3$	69.22	5.73	24.50	66.53	5.53*	1.94
$L_5 \times T_2$	62.99	4.50	12.50	35.52	6.90*	1.71
$L_5 \times T_3$	64.81	5.74	21.00	29.12	1.77	1.2
$L_6 \times T_4$	60.85	5.09	20.50	107.67*	7.52*	3.87*
$L_7 \times T_1$	64.08	5.61	33.00	41.16	4.04	1.15
$L_7 \times T_4$	80.53*	5.92	81.00*	122.39*	6.12*	1.41
$L_8 \times T_4$	86.53*	6.87	35.00	111.37*	7.11*	0.48
Mean	71.11	7.55	34.83	83.11	5.02	2.21
SEd	1.77	0.15	0.72	2.38	0.83	0.06
CD	3.65	0.32	1.05	2.91	0.17	0.13

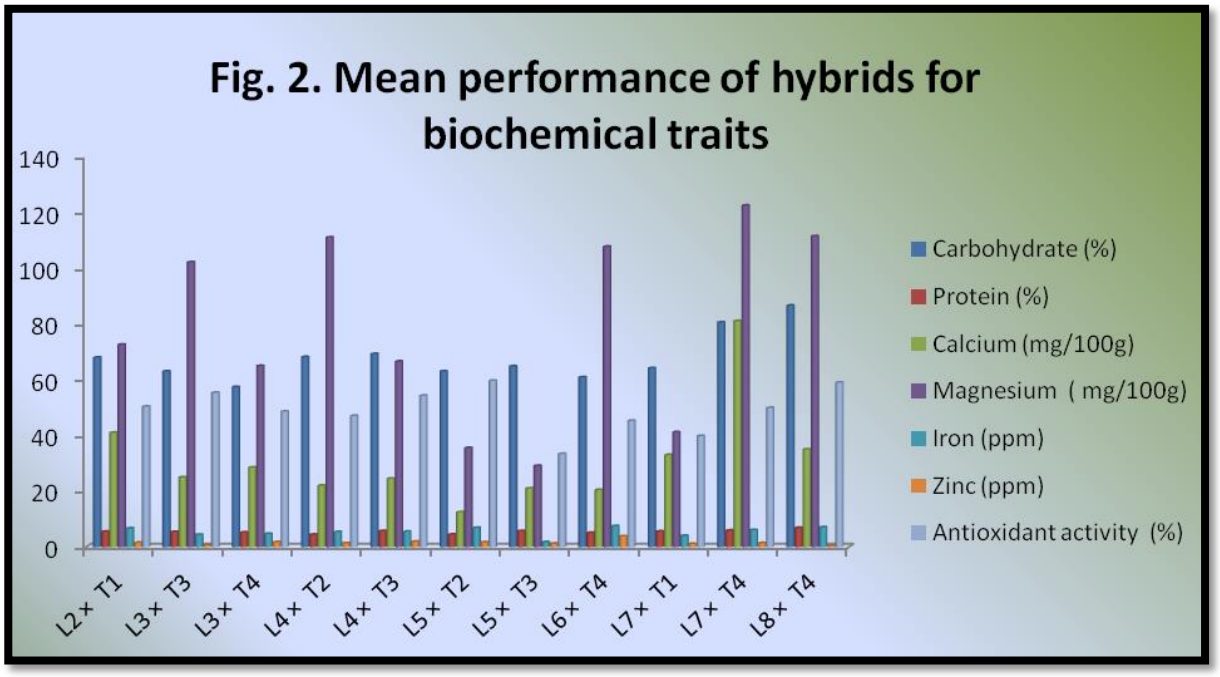


Genetic variability studies provide basic information regarding the genetic properties of the population. Knowledge on nature and magnitude of genotypic and phenotypic variabilities present in any crop species play an important role in formulating successful breeding programme [1]. The estimate of genetic variability (GCV and PCV) helps to select a potential genotype. High PCV and GCV were observed for protein, calcium, magnesium, iron, zinc contents. Moderate and high PCV and GCV respectively for carbohydrate content and micronutrients iron and zinc respectively [Table-2] and [Fig-2] [7]. Moderate PCV and GCV for protein, zinc and calcium contents were recorded [4]. Among the 12 selected high yielding hybrids and 13 parents, the phenotypic and genotypic coefficient of variations for nutritive traits were highest for calcium content followed by zinc, protein, magnesium, iron contents and low for carbohydrate content. This high variability indicated that, there is great diversity for these traits and hence, there is a scope for the improvement of these nutritive traits. The above results were in agreement with the reports [10] for iron and zinc contents.

The simple measures of variability like mean, variance and coefficient of variation reveal the extent of variability but not the heritable portion of the total variation. To have the knowledge of the heritable portion of variability, it is necessary to estimate the heritability of each character. The broad sense heritability gives an idea about the portion of observed variability attributable to genetic difference. In other words, heritability indicates the accuracy with which a genotype can be identified by its phenotypic performance. High heritability estimates were recorded for all the nutritive characters. This was in accordance with the results of sarawgi [9]. Heritability estimates give information on the magnitude of inheritance of quantitative traits but provides no indication about the amount of genetic progress that would result from selecting the best individuals. A suitable selection procedure can be followed only when the high heritability estimates in broad sense is accompanied by high genetic advance. The genetic advance measures and predicts the genetic gain under selection. High heritability with high genetic advance was exhibited by all the nutritive traits viz., carbohydrate, calcium, magnesium, iron and zinc contents and antioxidant activity while high heritability with moderate genetic advance was noticed for protein content. High heritability and genetic advance for iron and zinc contents was reported [10], while moderate heritability with moderate genetic gain was recorded for protein content [2].

Table-2 *Variability parameters for biochemical traits*

Characters	Range		Grand Mean	Variance		Coefficient of Variation (%)		Heritability (%)	Genetic advance as percentage of mean
	Minimum	Maximum		Phenotypic (PV)	Genotype (GV)	Phenotypic (PCV)	Genotypic (GCV)		
Carbohydrate content	57.34	86.53	71.11	87.79	84.64	11.06	10.99	98.75	22.50
Protein content	4.45	15.46	7.55	10.36	9.22	42.77	35.89	87.33	19.45
Calcium content	12.50	86.50	34.03	66.78	66.62	28.54	27.45	99.64	97.58
Magnesium content	29.12	163.30	83.11	381.23	380.66	41.95	41.76	99.12	85.66
Iron content	1.77	7.52	5.02	3.67	3.54	2.98	2.95	98.44	60.61
Zinc content	0.48	3.87	2.21	2.72	2.70	4.61	4.59	99.07	94.14



From the above study by comparing the biometrical and biochemical parameters it was concluded that there was narrow differences between PCV and GCV suggested that negligible influence of environmental factors whi ch was recorded in most of the characters and the hybrids ASD 16 x Veeradangan and IR 72 x Veeradangan were promising hybrid combination for future breeding programmes to select a better genotype with high nutritive value along with grain yield. The hybrid combinations ADT 43 x Chennellu and ADT 39 x Veeradangan recorded high values for yield attributing traits along with magnesium and iron contents which can be recommended for recombination breeding to get the better genotype for single plant yield along with high mineral and nutritive content.

References

[1] Allard R.W. (1960) *John Wiley and Sons. Inc*., U.S.A., 485 p.

[2] Ashwini Samak N.R., Shailaja Hittalmani, Shashidhar N. and Hanumareddy Biradar (2011) *Asian Journal of Plant Science*, 10 (7), 376-379.

[3] Gilbert N.E. (1958) *Heredity*, 13, 477-492.

[4] Govindaraj M., Selvi B., Rajarathinam S. and Sumathi P. (2011) *African Journal of Food, Agriculture, Nutrition and Development*, 11 (3).

[5] Hedge J.E. and Hofreiter B. T. (1962) *17 (Eds. Whistter R.L and Be Miller, J.N.), Academic Press, New York.*

[6] Lowry O.H, Rase Brough N.J., Farr A. L. and Randall R. J. (1951) *Journal of Biological Chemistry*, 193, p. 265.

[7] Premila Devi Thongbam, Tarentoshi, Mausumi Raychaudhury, Anna Durai, Shankar Prasad Das, Ramesh T. Patiram, Ramya K.T., Abdul Fiyaz R. and Ngachan S.V. (2012) *Journal of Agricultural Sciences*, 4 (3), 259-269.

[8] Riccharia R. H. and Govindasamy S. (1990) Academy of Development Science. Karjat.

[9] Sarawgi A.K., Rastogi N.K., Verma R. and Wade L. J. (2000) *Oryza*, 37(4), 217-276.

[10] Shanmuga Sundara Pandian G. (2007) M.Sc. (Ag.). Thesis, (unpubl.) TNAU, Coimbatore.