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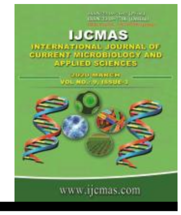

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Heritability and Genetic Advance Analysis in Rice (*Oryza sativa* L.) Genotypes under Aerobic Condition

Nikki Kumari* and M. B. Parmar

Main Rice Research Station, Anand Agricultural University, Nawagam - 387540, Gujarat, India

**Corresponding author*

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A B S T R A C T

The experiment was conducted in experimental Farm, Regional Research Station, Anand Agricultural University from July to November 2018toestimate the extent of variability present in rice genotypes with respect to yield and its component traits. The estimates of genotypic and phenotypic variances for the characters like plant height, effective tillers per plant, number of grains per panicle, grain yield per plant, straw yield per plant, harvest index and 1000 grain weight, genotypic variance contributed larger in phenotypic variance. The highest genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were observed for straw yield per plant (37.84%, 40.21%), followed by harvest index (24.20%, 29.02%) and grain yield per plant (22.45%, 26.34%). High heritability coupled with high genetic advance were observed for plant height, number of grains per panicle and straw yield per plant.

Introduction

Rice (*Oryza sativa* L.) is the most valuable crop in the world and the prime staple food of Asia, for more than 2/3rd of its population. Rice is the oldest domesticated grain (~10,000 years) and most important primary source of food for more than three billion people. Rice cultivated primarily in low land condition which required almost half of the water utilized for agricultural production. The depleting water resource demands others alternative approaches without compromising the productivity. Aerobic cultivation of rice is one of the most promising options among others such approaches. There are no specific genotypes available for aerobic cultivation of rice so breeder should pay attention in this direction. Genetic variability for agronomic traits is the main component of any breeding programs for widening the gene pool. The efficient use of genetic resources in all plant-breeding programs requires knowledge about genetic diversity.

Assessment of genetic variability present in the population and the extent to which it is heritable are important factors, to have effective selection in any breeding program. Genetic variability is an efficient tool for an effective choice of parents for hybridization program. Information about nature and degree of genetic divergence would help the plant breeder in choosing the right parents for the breeding program (Vivekanandan and Subramanian, 1993).

To boost the yield potential of aerobic rice, it is necessary to identify cultivars with improved yield and other desirable agronomic characters. Burton (1952) and Johnson *et al.*, (1955) reported that to arrive at a reliable conclusion, genetic variability and heritability should jointly be considered in totality so as to bring an effective improvement in yield and in other yield related characters.

Materials and Methods

The experimental material comprised of fifty selected genetically diverse true breeding genotypes of rice (*Oryza sativa* L.) obtained from different geographical regions. All the genotypes were grown in randomized block design with 3 replications under aerobic conditions in the *Kharif* season of year 2018. Each genotype was grown in 2.0 m x 0.9 m plot with 30 x 10 cm spacing at the Regional Research Station, Anand Agricultural University Anand, India. Standard agronomic practices and plant protection measures were followed.

Replication-wise data on the basis of five randomly taken competitive plants were recorded on following traits: Days to 50 per cent flowering (DFF), Plant height, Number of grains per panicle, Spikelet fertility per cent, Effective tillers per plant, Grain yield per plant, Straw yield per plant, Harvest index, 1000-grain weight, Grain length, Grain breadth and Grain L/B ratio.

The data recorded for all the characters were subjected to analysis of variance with the formula suggested by Panse and Sukhatme (1978). Further, Different components of variance *viz.*, phenotypic, genotypic and environmental variance were estimated and genetic parameters like genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV) and heritability in broad sense and genetic advance as percent of mean were worked out following appropriate statistical procedure.

Results and Discussion

Analysis of variance revealed significant differences among the different genotypes for all the 12 characters like days to 50 per cent flowering (DFF), plant height, effective tillers per plant, number of grains per panicle, spikelet fertility per cent, grain yield per plant, straw yield per plant, harvest index, 1000-grain weight, grain length, grain breadth and grain L/B ratio (Table 2), which clearly suggested the existence of sufficient amount of variability in the experimental material. The estimates of genotypic and phenotypic variances revealed that for the characters like plant height, effective tillers per plant, number of grains per panicle, grain yield per plant, straw yield per plant, harvest index and 1000 grain weight, genotypic variance contributed larger in phenotypic variance, which indicated less influence of environmental factors on the expression of these characters.

The phenotypic (Vp) and genotypic(Vg) coefficient of variation were obtained for different characters (Table 3). The highest genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were observed for straw yield per plant (37.84%, 40.21%), followed by harvest index (24.20%, 29.02%) and grain yield per plant (22.45%, 26.34%).High GCV values with marginally high PCV values indicated that inter-accession variations were high and that the expression of these characters was less influenced by the environment factor and low differences between GCV and PCV value revealed sufficient variability in the population under investigations. These results are akin to the findings of Khan *et al.,* (2009), Akinwale *et al.,* (2011) and Ketan and Sarkar (2015).

Knowledge on the heritability is very much important to a plant breeder since it indicates the possibility and extent to which improvement is possible through selection. Burton (1952) suggested that genotypic co-efficient of variation along with heritability estimates would provide a better picture of genetic gain expected through phenotypic selection. The relative amount of heritable portion was assessed in the present study with the help of estimates of broad sense heritability. The heritability estimates were very high for 1000 grain weight (90.20%) the results were in correspondence to the findings of Karim *et al.,* (2007) and Osman *et al.,* (2012); moderately high for plant height (84.90%), effective tillers per plant (85.20%), number of grains per panicle (85.90%), grain yield per plant (72.70%), straw yield per plant (88.60%) and harvest index (69.50%), Similar results were also reported by Khan *et al.,* (2009), Pandey *et al.,* (2009) and Akinwale *et al.,* (2011) and moderate heritability estimates were found for days to 50 per cent flowering (39.50%) and spikelet fertility (41.40). The heritability estimates were very low for grain L/B ratio (27.27%), grain breadth (20%) and grain length (14.70), similar results were reported by Patel *et al.,* (2018) while Ketan and Sarkar (2014) reported only low genetic advance as per cent of mean for grain length.

The heritability estimates along with genetic advance are more useful than the former alone in predicting the best performing individuals. Genetic gain gives an indication of expected genetic progress for a particular trait under suitable selection procedure. High heritability coupled with high genetic advance as per cent of mean were observed for effective tillers per plant (35.94%), plant height (28.39%), number of grains per panicle (37.11%), grain yield per plant (39.31%), 1000 grain weight (33.66%), harvest index (41.56%) and straw yield per plant (74.77%), Similar results had also been reported by Akinwale *et al.,* (2011) and Ketan and Sarkar (2014), which indicated better scope of their improvement through selection, as these characters were predominantly governed by additive genetic variance. Low genetic advance as per cent of mean coupled withlow estimates of heritability were observed for days to 50 per cent flowering, grain L/B ratio, grain breadth and grain length, the results indicated involvement of non-additive gene effect for expression of these trait and hence, population improvement approach would be most effective for improvement of these characters. These findings are in conformity with Patel *et al.,* (2018), while Ketan and Sarkar (2014) reported only low genetic advance as per cent of mean for grain length.

On the basis of all the above findings, it can be concluded that, while imposing selection for genetic improvement of grain yield in rice under aerobic condition, due weightage should be given to effective tillers per plant, plant height, number of grains per panicle, grain yield per plant, 1000 grain weight, harvest index and straw yield per plant. Presence of sufficient variability in the characters studied offer possibilities to explore the material for further genetic improvement program to widen the genetic background of various rice genotypes.

Table.1 Analysis of variance for different characters in rice

Sr. No.	Character	Mean sum of square		
		Replication	**Genotype**	**Error**
	Degree of freedom	02	49	98
1	Day to 50 per cent flowering	4.120	31.010*	10.474
2	Plant height	348.930	651.469*	36.481
3	Effective tillers per plant	1.320	7.596*	0.414
4	Number of grains per panicle	201.500	1320.143*	68.459
5	Spikelet fertility (%)	15.370	73.798*	23.639
6	Grain yield per plant	14.460	31.612*	3.522
7	Straw yield per plant	340.950	932.050*	38.504
8	Harvest index (%)	22.070	119.594*	15.246
9	1000 grain weight	0.810	44.981*	1.570
10	Grain length	0.004	0.424*	0.279
11	Grain breadth	0.033	0.084*	0.048
12	Grain L/B ratio	0.078	0.256*	0.119

Note: * indicate significant at 5% level

Table.2 The estimate of genotypic and phenotypic variances and other genetic parameters for different characters in rice

Sr. No.	Character	σ^2_g	σ^2_p	GCV (%)	PCV (%)	H^2_b (%)	GA (%)
1	Days to 50 per cent flowering	6.85	17.32	3.65	5.81	39.50	4.73
2	Plant height	204.99	241.47	14.96	16.23	84.90	28.39
3	Effective tillers per plant	2.39	2.80	18.89	20.46	85.20	35.94
4	No. of grains per panicle	417.23	485.68	19.44	20.97	85.90	37.11
5	Spikelet fertility (%)	16.72	40.35	4.41	6.86	41.40	5.84
6	Grain yield per plant	9.36	12.88	22.45	26.34	72.70	39.31
7	Straw yield per plant	297.85	336.35	37.84	40.21	88.60	74.77
8	Harvest index	34.78	50.02	24.20	29.02	69.50	41.56
9	1000 grain weight	14.47	16.04	17.21	18.12	90.20	33.66
10	Grain length	0.048	0.327	2.39	6.21	14.70	1.84
11	Grain breadth	0.012	0.060	4.17	9.41	20.00	3.81
12	Grain L/B ratio	0.045	0.165	6.01	11.48	27.27	6.44

Fig.2.1 Graphical representation of genotypic and phenotypic variance

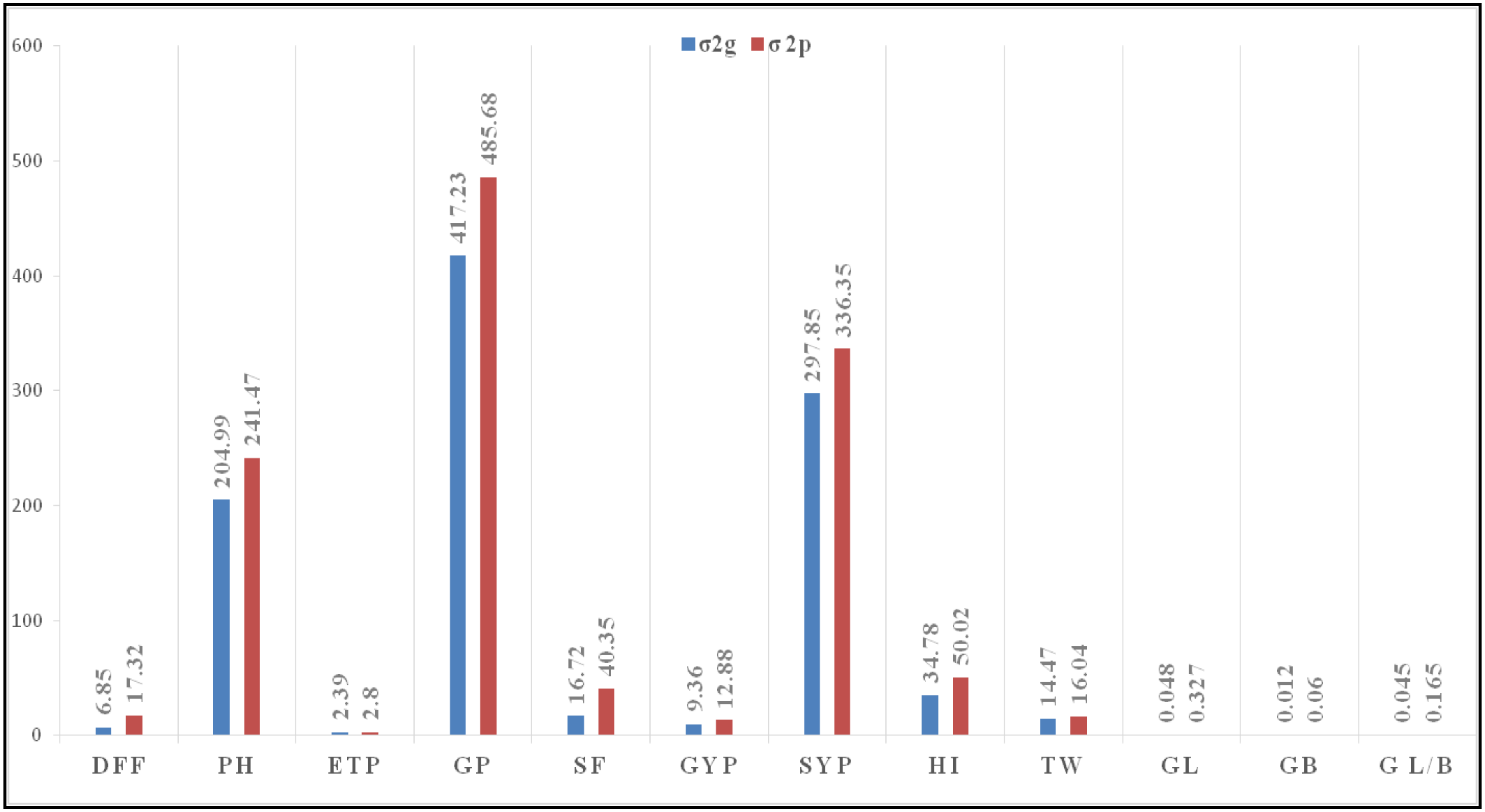


Fig.3.1 Graphical representation of genotypic and phenotypic coefficient variation

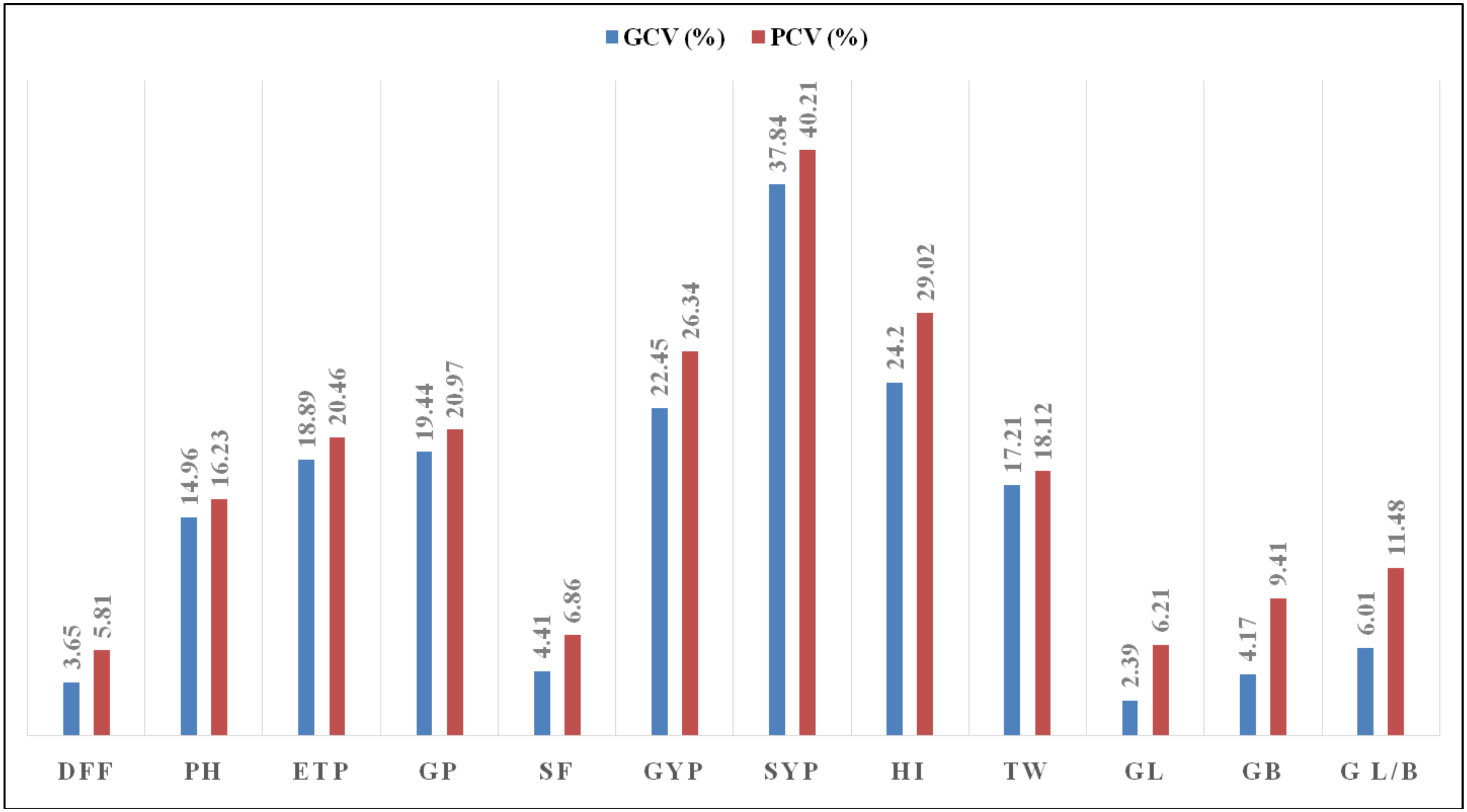
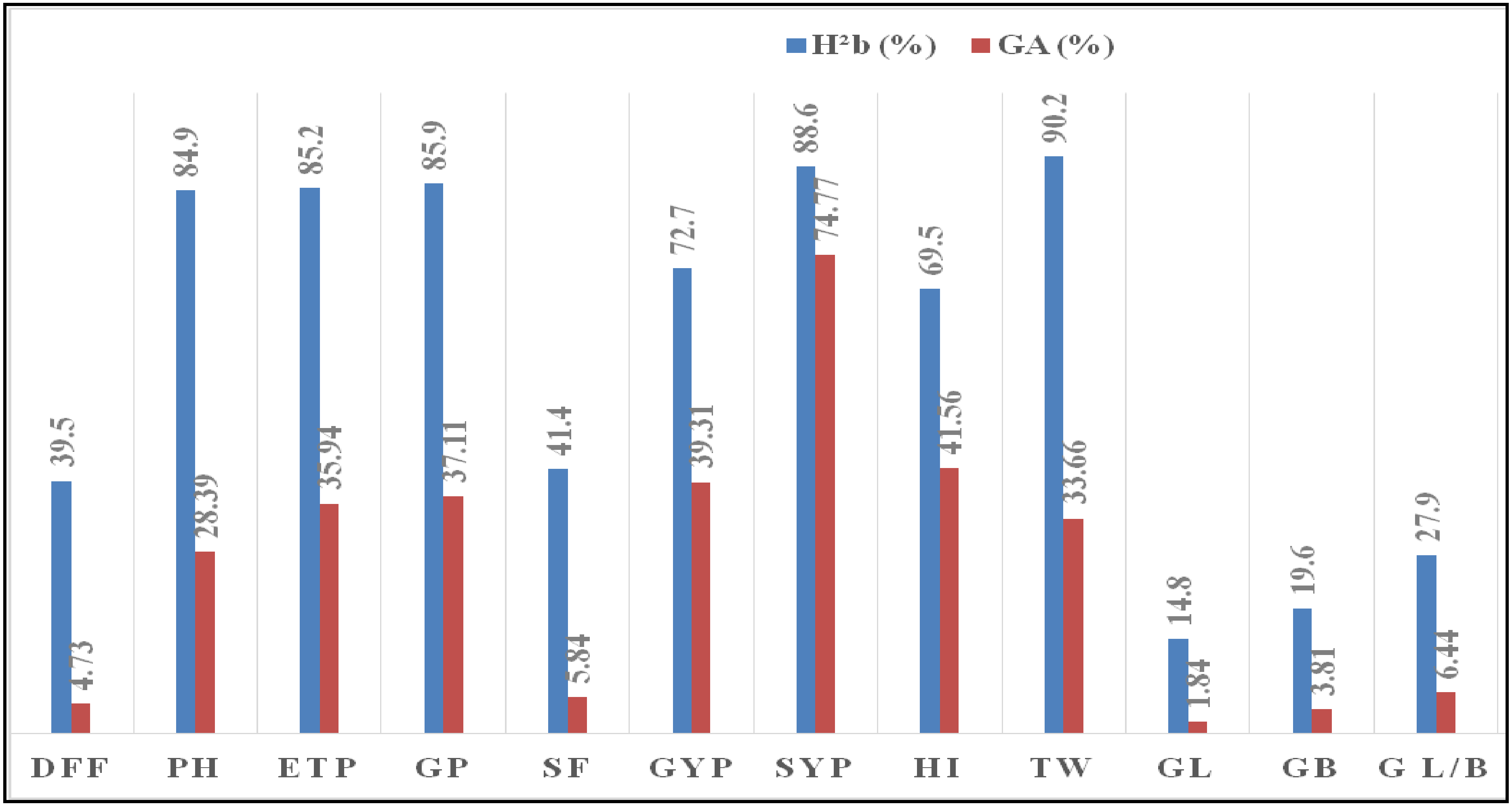


Fig.3.2 Graphical representation of broad sense heritability and genetic advance as per cent mean



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