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Genetic parameters and their association with grain yield in quinoa (*Chenopodium quinoa* Willd) under late sown condition

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ABSTRACT

One hundred forty promising lines of quinoa were evaluated during rabi season of 2019-2020 to study the genetic parameters and their association with grain yield and its attributes. Heritability was high for all the traits. High heritability coupled with high genetic advance expressed as percentage of mean was observed for grain yield per plant, number of primary branches per plant, days to maturity, plant height and number of inflorescence per plant. Moreover grain yield per plant exhibited positive and significant association with plant height, length of inflorescence per plant, number of inflorescence per plant, number of primary branches per plant and stem diameter per plant . Therefore selection based on these characters would be effective for improving the grain yield and its attributes in quinoa under late sown condition of Chhattisgarh state.

Keywords: Genetic parameters; grain yield; association; quinoa

INTRODUCTION

Quinoa (*Chenopodium quinoa* Willd) is a herbaceous plant more specially a tetraploid crop. With an increasing demand and production in other countries, quinoa's native regions which mostly rely on its production for nutrition and economic survival, might suffer negative consequences due to this interest. In India Andhra Pradesh, Himachal Pradesh and Uttaranchal are emerging as the main cultivators of quinoa unlike wheat and rice.

Quinoa is not a grass rather a pseudo-cereal botanically related to spinach and amaranth and originated in the Andean region of northwestern South America. The protein content in grains is higher than the other cereals while it has better distribution of essential amino acids.

Quinoa plant is resistant to cold, salt and drought. The area and production of quinoa in Chhattisgarh is negligible. After harvest of late duration crop of paddy, farmers go for sowing of its rabi crop in Chhattisgarh areas. Looking to this situation it was felt that there was need to evaluate the promising lines of quinoa under late sown condition as to ascertain its possibility of cultivation in Chhattisgarh area. Simultaneously the study of genetic parameters and their association with yield has been done for genetic improvement in quinoa.

MATERIAL and METHODS

The experiment was conducted at instructional cum research farm of Department of Genetics and Plant Breeding, IGKV, Raipur, Chhattisgarh. Germplasm was obtained by farmers of village Bhankhedi, Block Pisawar, Dist Sehore, Madhya Pradesh during 2018-19. From these seed materials 140 lines were selected and grown in RBD with two replications during 2019-2020. Each plot consisted of 2 rows of 4 metre length with row to row spacing of 30 cm. Fertilizer was applied at the rate of 40 kg nitrogen, 60 kg super phosphate, 20 kg potash and 20 kg sulfur per hectare. Observations were recorded on 5 randomly taken plants in each replication for 7 quantitative characters (Table 1). The variability parameters were calculated by the method proposed

by Burton (1952) and Johnson et al (1955). The correlation coefficients were worked out as per Singh and Chaudhary (1979).

RESULTS and DISCUSSION

The mean squares due to germplasm indicated the significant variability for different characters of the material under study. The existence of very high magnitude of genetic variability was also evidenced through high values of genotypic coefficient of variation for majority of the traits. A relative comparison on the magnitude of genotypic coefficient of variation (GCV) for various traits exhibited that maximum amount of genetic variability was observed for plant height, days to maturity, grain yield per plant, number of primary branches per plant and number of inflorescence per plant. The low GCV was observed for stem diameter and length of inflorescence (Table 1). Phenotypic coefficient of variation (PCV) was higher than GCV for all the characters.

Heritability (broad sense) estimates were found to be high for all the traits. Bhargava et al (2003) in similar study on quinoa also observed high heritability in mean plant height, stem diameter per plant, number of primary branches per plant, number of inflorescence per plant, length of inflorescence and grain yield per plant except days to maturity. A relative comparison of heritability coupled with high genetic advance as per cent of mean gives an idea about the nature of gene action governing a particular character.

A comparison of these two estimates made in this study revealed that seed yield per plant, number of primary branches per plant, days to maturity, plant height and number of inflorescence per plant had high heritability accompanied with high expected genetic advance as per cent of mean indicated the substantial contribution of additive genetic variance in the expression of these characters. Rest of the characters like length of inflorescence and stem diameter per plant showed high heritability estimates coupled with medium genetic advance as per cent of mean indicating the significant contribution of non-additive gene effect observed for these characters.

On the basis of the overall observation of the findings of heritability estimates and expected genetic advance as per cent of mean, it could be concluded that the selection criteria based on grain yield per plant, number of primary branches per plant, days to maturity, plant height and number of inflorescence per plant would serve the purpose in the improvement of grain yield in quinoa. The results are in disagreement with the findings of Bhargava et al (2003) except number of inflorescence per plant.

Grain yield per plant had significant and positive correlation with plant height, length of inflorescence, primary branches per plant and stem diameter per plant (Table 2). Days to maturity had positive and significant association with plant height and number of inflorescence per plant. Plant height exhibited positive and significant correlation with length of inflorescence, number of inflorescence per plant,

Table 1. Genetic parameters of variation for grain yield and its components in quinoa

Parameter	Days to maturity	Plant height (cm)	Length of inflorescence (cm)	Number of inflorescence /plant	Number of primary branches/plant	Stem diameter /plant (cm)	Grain yield /plant (g)
Mean	97.5	111.45	23.00	22.5	21.00	2.75	34.35
Genotypic variance	81.18	105.25	1.88	4.34	4.23	0.03	16.08
Phenotypic variance	87.64	113.68	2.02	4.65	4.27	0.036	18.06
GCV	83.26	94.43	8.17	19.28	20.14	1.09	46.81
PCV	89.88	102.00	8.78	20.66	20.33	1.30	52.57
$H^2_{(B)\ (\%)}$	92.62	92.58	93.06	93.33	99.06	83.33	89.03
Genetic advance	17.86	20.33	4.14	4.14	4.21	0.32	7.79
Genetic advance (% of mean)	18.31	18.24	18.42	18.42	20.07	11.84	22.69

Table 2. Genotypic correlation of grain yield with its components in quinoa

Character	Days to maturity	Plant height (cm)	Length of inflorescence (cm)	Number of inflorescence /plant	Number of primary branches/plant	Stem diameter /plant (cm)	Grain yield /plant (g)
Days to maturity	-	0.761*	0.291	0.725*	-0.766*	0.333	0.863**
Plant height (cm)	-	-	03862**	0.751*	0.742*	0.933**	0.772*
Length of inflorescence (cm)	-	-	-	-0.111	0.119	0.708*	0.886**
Number of inflorescence/plant	-	-	-	-	-0.860**	0.181	0.775*
Number of primary branches/plant	-	-	-	-	-	-0.201	0.672*
Stem diameter /plant (cm)	-	-	-	-	-	-	0.832**
Grain yield/plant (g)	-	-	-	-	-	-	-

number of primary branches per plant and stem diameter per plant. Length of inflorescence showed positive and significant association with stem diameter per plant. Days to maturity had significant but negative correlation with number of primary branches per plant and number of inflorescence per plant also exhibited negative and significant association with number of primary branches per plant. Similar observations were made by Bhargava et al (2003).

Thus it is clear that the selection based on grain yield per plant, plant height, length of inflorescence, number of inflorescence per plant, number of primary branches per plant and stem diameter per plant can give better results for the improvement of grain yield in quinoa under late sown condition in Chhattisgarh state.

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