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Study about Correlation and Path Analysis in Grain Amaranth (*Amaranthus hypochondriacus* L.)

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Twenty six genotypes of grain amaranth were evaluated during *rabi* 2017-18 for assessing the correlation and path coefficient analysis for grain yield and its components. The grain yield per plant was found to be positively and significantly associated with plant height, panicle length, dry weight of leaves, dry weight of panicles, biological yield/plant and harvest index. Dry weight of panicles had highest path towards grain yield per plant, dry weight of leaves directly associated with days to maturity and plant height. This indicates that these characters played an important role in higher grain yield in grain amaranth.

Keywords: Grain amaranth; correlation; path analysis; grain yield per plant.

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1. INTRODUCTION

Amaranth belongs to the family Amaranthaceae and genus Amaranthus. Grain amaranth is an important multifarious utility cash crop of the higher hill as well as plane zone where, it is grown mainly as a pure crop. Acreage and production of grain amaranth in Chhattisgarh state is unknown. The production is 229/ha in plane zone area of Chhattisgarh [1]. It is a potential nutritional crop as the grain contain 16-18 percent protein which other commonly used cereals like rice, wheat, maize, quinoa and buckwheat do not contain this much protein. Grain yield being the most important and polygenic ally controlled complex character. It is governed by many physiological changes within the plant and influenced by many environmental factors, hence, it is not an efficient character for selection. Inter relationship among direct and indirect influence of component characters of grain yield is important in predicting the correlated response to directional selection and in detection of traits as useful mashers [2].

2. MATERIALS AND METHODS

The present experiment was conducted at Research Cum Instructional form, Department of genetics and plant breeding, IGKV, Raipur (CG) during *rabi* 2017-2018. The material comprised of 26 genotype (including 3 checks namely Chhattisgarh rajgira-1, RMA-7 and suvarna). The experiment was laid out in a Randomized Block Design with three replications, each genotype was raised in bed size of 3m x 0.9m. Matric observations was recorded, all the recommended agronomic practices were followed to facility good crop growth and development, Analysis of variance was calculate by the suggested formula of Panse and Sukhatine [3]. The genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were calculated by the formula given by Burton [4]. Heritability in broad sense was calculated by formula suggested by Hanson et al. [5]. From the heritability estimates, the genetic advance was estimated by the formula by Johanson et al. [6].

3. RESULTS AND DISCUSSION

In general, genotypic correlations were higher than their corresponding phenotypic correlations in almost all the cases, there by suggesting strong inheritant association between various characters at genotypic level (Table 1). At phenotypic level, grain yield per plant indicated a significant positive association with panicle length, dry weight of leaves, dry weight of panicles, biological yield/plant and harvest index.

The grain yield per plant was found to be positively and significantly associated with plant height, panicle length, dry weight of leaves, dry weight of panicles, biological yield/plant and harvest index, which indicated that selection for these traits, would lead to an improvement in yield. It is interesting to note that all the characters under study showed positive association with grain yield. Shukla and Singh [2] also observed significant and positive association for grain yield with plant height. Negative and significant correlation of days to maturity with grain yield indicated that selection for maturity cannot be combined with grain yield.

Plant height influenced greatly panicle length, dry weight of panicles, biological yield/plant; stem girth with panicle length, dry weight of panicles; panicle length will all traits except panicle width, 1000 grain weight; panicle width with 1000 grain weight; dry weight of leaves with dry weight of panicles and harvest index; dry weight of panicles with dry weight of stem, biological yield/plant; dry weight of stem with biological yield/plant.

The genotypic correlations were partitioned into direct and indirect effects to know the relative importance of the components (Table 2). It is interesting to note that dry weight of panicles had highest direct path towards grain yield. Dry weight of leaves, day to maturity and plant height directly associated. This indicates that dry weight of panicles played an important role in higher grain yield due to more photosynthetic activity. Similarly, days to maturity had higher positive correlation with grain yield, had next higher positive direct effect path (3,565). It was also indirectly and positively affected *via* stem girth, biological yield/plant, 1000 grain weight and harvest index. Low non significant correlation and direct path of panicle width, dry weight of stem and 1000 grain weight with grain yield per plant indicated that much reliance cannot be placed on the selection of this traits in enhancing the grain yield, which confirmed the conclusion drawn from association plant height had significant positive correlation with grain yield per pant and direct path, which is in agreement with general expectation *i.e,* the more panicle length, dry weight of leaves, dry weight of stem and 1000 grain weight, the more will be grain yield.

Table 1. Genotypic (G) and Phenotypic (P) correlation coefficients for grain yield and its components in grain amaranth

S. No.	Characters		Days to 50% flowering	Days to maturity	Plant Height (cm)	Stem girth (cm)	Panicle length (cm)	Panicle width (cm)	Dry weight of leaves (g)	Dry weight of panicle (g)	Dry weight of stem (g)	Biological Yield/plant (g)	1000 grain weight (g)	Harvest index (%)	Grain yield per plant (g)
1	Days to 50% flowering	G	-												
		P	-												
2	Days to maturity	G	-0.009	-											
		P	0.021	-											
3	Plant height (cm)	G	-0.009	-0.258*	-										
		P	-0.019	-0.183	-										
4	Stem girth	G	0.952**	-0.511**	0.142	-									
	(cm)	P	0.509**	-0.390**	0.238*	-									
5	Panicle length	G	0.364**	-0.547**	0.386**	0.365**	-								
	(cm)	P	0.308**	-0.448**	0.373**	0.243*	-								
6	Panicle width	G	0.048	0.354**	0.184	-0.340**	0.110	-							
	(cm)	P	0.174	0.374**	0.136	-0.250*	0.157	-							
7	Dry weight of leaves (g)	G	-0.107	-0.719**	-0.027	0.089	0.632**	-0.478**	-						
		P	-0.228	-0.541**	-0.108	0.117	0.302**	-0.382**	-						
8	Dry weight of panicle (g)	G	0.018	-0.711**	0.370**	0.294**	0.452**	-0.147	0.235*	-					
		P	0.108	-0.596**	0.354**	0.210**	0.488**	0.031	0.101	-					
9	Dry weight of stem (g)	G	-0.442**	-0.148	0.212	-0.151	-0.174	-0.358*	0.046	0.567**	-				
		P	-0.271*	-0.166	0.183	-0.048	-0.083	-0.197	0.055	0.550**	-				
10	Biological	G	-0.011	-0.595**	0.344**	0.169	0.335**	-0.234*	0.193	0.960**	0.766**	-			
	Yield/plant (g)	P	-0.011	-0.514**	0.339**	0.154	0.370**	-0.066	0.125	0.944**	0.771**	-			
11	1000 grain weight (g)	G	-0.113	0.277*	0.200	-0.090	0.370	0.698**	-0.429**	-0.076	-0.119	-0.083	-		
		P	0.228*	0.263*	0.242	-0.027	0.092	0.727**	-0.312**	0.067	0.006	0.060	-		
12	Harvest index (%)	G	-0.111	-0.526**	0.162	0.139	0.552**	-0.183	0.635**	0.216	-0.222	0.090	-0.293	-	
		P	-0.009	-0.432**	0.011	-0.019	0.426	-0.081	0.343**	0.142	-0.237*	0.010	-0.225	-	
13	Grain yield per plant	G	-0.069	-0.709**	0.274*	0.096	0.700**	-0.014	0.675**	0.610**	0.079	0.489**	-0.073	0.777**	-
	(g)	P	-0.022	-0.664**	0.193	0.078	0.648**	-0.033	0.422**	0.594**	0.146	0.494**	-0.089	0.675**	-

Table 2. Genotypic path coefficients of various characters for grain yield/plant (g) in grain amaranth

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	Stem girth (cm)	Panicle length (cm)	Panicle width (cm)	Dry weight of leaves (g)	Dry weight of panicle (g)	Dry weight of stem (g)	Biological yield/plant(g)	1000 grain weight (g)	Harvest Index (%)	Genotype'r' Grain yield per plant (g)
Days to 50%flowering	**1.75**	-0.030	-0.001	-0.458	0.013	-0.011	-0.460	0.557	-5.008	3.770	0.149	-0.396	-0.069
Days to maturity	-0.015	**3.565**	-0.038	0.246	-0.019	-0.082	-3.078	-21.55	-1.674	20.25	0.366	1.074	0.709**
Plant height (cm)	-0.015	-0.918	**0.148**	-0.068	0.014	-0.042	-0.117	11.20	2.400	-11.71	0.264	-0.798	0.274*
Stem girth (cm)	1.671	-1.820	0.021	**-0.481**	0.013	0.078	0.381	8.903	-1.710	-5.743	-0.119	-1.031	0.096
Panicle length (cm)	0.638	-1.950	0.057	-0.175	**0.036**	-0.025	2.707	13.71	-1.977	-11.38	0.048	-0.723	0.700**
Panicle width (cm)	0.084	1.263	0.027	0.164	0.004	**-0.231**	-2.047	-4.467	-4.058	7.953	0.925	0.281	-0.014
Dry weight of leaves (g)	-0.188	-2.563	-0.004	-0.042	0.023	0.110	**4.282**	7.129	-0.524	-6.562	-0.569	-0.114	0.675**
Dry weight of panicles (g)	0.032	-2.535	0.054	-0.141	0.016	0.034	1.007	**30.30**	6.431	-32.67	-0.100	-1.726	0.610**
Dry weight of stem (g)	-0.775	-0.526	0.031	0.072	-0.006	0.082	-0.197	17.19	**11.33**	-26.07	-0.157	-1.011	0.079
Biological yield/plant (g)	-0.194	-2.121	0.051	-0.081	0.012	0.054	0.825	29.101	8.686	**-34.02**	-0.110	-1.664	0.489**
1000 grain weight (g)	0.375	-2.065	0.063	-0.268	0.014	0.035	0.264	28.21	6.185	-30.54	**-0.009**	-1.854	-0.073
Harvesting Index (%)	-0.194	-1.875	0.024	-0.067	0.020	0.042	2.719	6.561	-2.518	-3.060	-0.389	**-0.009**	0.777**

Residual effect (R) = 0.786 **, ** Significant at 5% and 1% level respectively*

Diagonal bold values are direct effect

4. CONCLUSION

Dry weight of leaves showed significant positive association with grain yield *via* dry weight of panicles and panicle width. Biological yield/plant had significant positive correlation with grain yield/plant, but had negative direct effect (-34.02). Dry weight of panicles, dry weight of leaves, plant height and days to maturity were found important components of grain yield. Thus, selection for these traits could be practiced for improve grain yield.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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