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Short Communication

Correlation and path analysis in grain amaranth (*Amaranthus* spp.)

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Amaranthus spp. are being cultivated since centuries for leafy vegetable [1] as well as important subsidiary food grain crop [2] under varied agro climatic conditions ranging from tropical to temperate zones. To exploit its potentiality for grain, several genetic improvement techniques have been done. Grain yield being the most important and polygenically controlled complex character, is also governed by many physiological changes within the plant and influenced by many environmental factors in which the plant is grown, hence it is not an efficient character for selection. Interrelationship among direct and indirect influence of component characters of yield is important in predicting the correlated response to directional selection and in the detection of traits as useful markers. Report on this aspect is scanty in this crop [3,4] hence, the present study was conducted to elucidate the genetic association among different agronomic traits in grain amaranth.

Sixty-six genotypes of *Amaranthus* spp. were grown in RBD with 3 replications during 1997-98 at experimental field of NBRI, Lucknow. Each entry was sown in two rows, each 3 meter long, The row to row and plant-to-plant distances was maintained 45 cm and 15 cm, respectively. Normal cultural practices were followed through out the crop season (Oct.-March). Fertilizer @ 40 kg nitrogen, 40 kg super phosphate and 20 kg potash were applied. Full amount of super phosphate and potash and 1/2 of the N_2 was applied as basal dose. Rest of the N_2 was applied in two split as top dressing. Three weedings followed by hoeing were done and 4-5 irrigations were given during the crop season. The observations were recorded on 5 plants from each entry and replicates for grain yield (g) and its 9 agronomic traits. The correlation and path coefficient analysis was computed according Dewey and Lu [5].

In general genotypic correlations were higher than their corresponding phenotypic correlations in all the cases, thereby suggesting strong inherent association between various characters at genetic level (Table 1). At phenotypic level, grain yield/plant showed a significant positive association with plant height and leaf size; plant height with number of primary branches/plant, number of spikelets/spike, number of nodes/plant and leaf size; number of spikelets/spike with no. of nodes/plant and leaf size; and number of nodes/plant with leaf size. The grain yield/plant was found to be positively and significantly associated with plant height (0.572), number of inflorescence/plant (0.475), number of spikelets/spike (0.45) and leaf size (0.530), which indicated that selection for these traits, would lead to an improvement in yield. It is interesting to note that all the traits under study showed positive genotypic association with grain yield. Pandey [3] also observed significant and positive correlation for grain yield with plant height, days to flower and number of panicles/plant. Significant association of leaf size with grain yield indicates that the larger leaves are more responsible for higher grain yield due to high photosynthetic activity. This character was also positively associated with all characters except inflorescence length. Days to flowering was significantly and positively associated with leaf size, suggesting leaf size increases with the increase in days to flower. Positive association of days to flower and days to maturity with seed yield and negative association with each other indicated that the selection for earliness can not be combined with above components. The plant height influenced greatly no. of primary branches/plant, number of inflorescence/plant, number of spikelets/spike, number of nodes/plant and leaf size as it is positively and significantly associated with these traits.

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 leaf size which had next to highest genotypic correlation exhibited highest direct path towards grain yield. Leaf size was indirectly associated via days to flower, days to maturity, plant height and number of inflorescence/plant. This indicates that leaf size played an important role in higher grain yield due to more photosynthetic activity. Similarly, Plant height, which had higher positive correlation with grain yield, also had next highest positive direct path (0.535). It was

Table 1. Genotypic and phenotypic (in parenthesis) correlation coefficients in grain amaranth

Characters	Days to flower	Days to maturity	Plant height (cm)	No. of primary br./plant	No. of inflores. /plant	Inflores. length (cm)	No. of spikelets/ spike	No. of nodes/ plant	Leaf size (cm^2)
Grain yield/plant	0.152 (0.108)	0.172 (0.077)	0.572* (0.461*)	0.220 (0.150)	0.475* (0.364)	0.199 (0.216)	0.450* (0.313)	0.250 (0.207)	0.530* (0.405)
Days to flower		−0.002 (−0.020)	0.202 (0.185)	0.396 (0.358)	0.171 (0.159)	−0.293 (−0.239)	0.287 (0.219)	0.308 (0.278)	0.459* (0.332)
Days to maturity			−0.076 (-0.068)	−0.324 (−0.270)	−0.032 (-0.031)	0.147 (0.085)	0.343 (0.224)	0.367 (0.310)	0.068 (0.046)
Plant height (cm)				0.635* (0.584*)	0.425* (0.391)	0.199 (0.218)	0.584* (0.474*)	0.528* (0.507*)	0.514* (0.424*)
No. of primary branches/plant					0.266 (0.307)	0.106 (0.083)	0.324 (0.278)	0.329 (0.313)	0.465* (0.372)
No. of inflorescence/plant						−0.086 (−0.043)	0.436* (0.335)	0.382 (0.381)	0.352 (0.252)
Inflorescence length (cm)							−0.181 (−0.190)	−0.174 (−0.110)	−0.386 (−0.174)
No. of spikelets/spike								0.687** (0.564*)	0.745** (0.536*)
No. of nodes/plant									0.588* (0.464*)

*Significant at 5%; **Significant at 1%

Table 2. Path coefficient analysis in grain amaranth

Character	Days to flower	Days to maturity	Plant height (cm)	No. of primary br./plant	No. of inflores./ plant	Inflores. length (cm)	No. of spikelets/ spike	No. of nodes/ plant	Leaf size (cm^2)	Genotypic correla-tion
Days to flower	0.044	0.000	0.108	−0.141	0.060	−0.100	−0.840	−0.118	0.384	0.152
Days to maturity	0.000	0.245	−0.041	0.115	−0.011	0.050	−0.101	−0.141	0.057	0.172
Plant height (cm)	0.009	−0-019	0.535	−0.225	0.150	0.068	−0.172	−0.203	0.430	0.572*
No. of primary branches/plant	0.018	−0.079	0.339	−0.355	0.094	0.036	−0.095	−0.126	0.389	0.220
No. of inflorescence/plant	0.008	−0.008	0.227	−0.940	0.352	−0.029	−0.129	−0.147	0.295	0.475*
Inflorescence length (cm)	−0.013	0.036	0.106	−0.038	−0.030	0.340	0.053	0.067	−0.323	0.199
No. of spikelets/spike	0.013	0.084	0.312	−0.115	0.154	−0.062	−0.295	−0.264	0.623	0.450*
No. of nodes/plant	0.014	0.090	0.282	−0.117	0.135	−0.059	−0.202	−0.384	0.492	0.250
Leaf size (cm^2)	0.020	0.017	0.275	−0.165	0.124	−0.131	−0.219	−0.226	0.836	0.530*

Residual effect = 0.274

also indirectly and positively affected via days to flower, number of inflorescence/plant, inflorescence length and leaf size. Low non-significant correlation and direct path of days to flower with grain yield indicated that much reliance cannot be placed on the selection of early types in enhancing the grain yield, which confirmed the conclusion drawn from correlation. Number of inflorescence/plant had significant positive correlation with grain yield and moderate direct path, which is in agreement with the general expectation i.e. larger the number of inflorescence, the more will be grain yield. Number of spikelets/spike had significant positive correlation with seed yield, but had negative direct path (-0.295). Contrary to this inflorescence length, which had non-significant correlation, exhibited high direct path towards seed yield. The lower genotypic correlation of inflorescence length with grain yield was counter balanced by high direct path and positive indirect effect via plant height, spikelets/spike and nodes/plant. Leaf size, plant height, no. of inflorescence/plant, inflorescence length and days to maturity were found important components of grain yield. Thus selection for one or more than one of the above character could be practiced for improving grain yield. Further to keep balance of growth period, genotypes with medium height and maturity coupled with optimum inflorescence length, number of inflorescence/plant with compact spike and leaf size should be taken as criteria for increased grain yield in amaranth.

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