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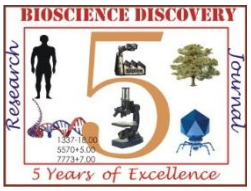

Full Length Article

Strategy of biometric evaluation of vegetative yield attributes of Amaranth cultivars

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ABSTRACT

Amaranthus sp (L.) collectively known as amaranth, is a cosmopolitan genus of herbs. Amaranth is nutritionally rich non cereal crop capable of preventing malnutrition and identified as an alternative crop. Despite the increasing of economical importance of amaranth, limited information is available on genetic variability for the agronomic traits among cultivars. The aims of this work were to estimate yield components of each genotype viz. the variance components, phenotypic and genotypic coefficients, heritability and genetic advance (ga). The present studies was conducted at the University of Burdwan, Crop Research Farm during the month of August 2012 and were evaluated eight genotypes of *Amaranthus* sp .The study indicated existence of considerable amount of genetic variability for all the traits except leaf length in 60 days. PCV is highest in the character leaf plant/ plant in 60 days and lowest in the character branch number/ plant in 90 days.The results stated that leaf / plant in 60 days and branch number / plant in 90 days could be useful character for the improvement of amaranth breeding programme.

Key words: Amaranth, agronomic trait, heritability, genetic advance

INTRODUCTION

*Amaranthus*sp (Family *Amaranthaceae*) provides over 75 wild and weedy species native to tropical and temperate regions of the globe (Sauer, 1993). The centre of origin of amaranth (*Amaranthus* spp.) cultivation is Central and South America. The high nutritional value of amaranth seeds, functional potential, brief growth cycle, adaptability to unfavourable climate and soil condition and the food use of the entire plant is the reason for increasing research interest in this pseudocereal (Pospišil et al., 2006; Capriles et al., 2008). Though it has been reported that the vegetable amaranths is still now ignored by the world of science (National Academy of Sciences, 2006). Many authors actually labeled them as 'neglected crops (Mnzava *et al.,* 1999; Van der Walt *et al.,* 2009). Several species can be utilized (National Research Council, 1984) for higher research programme. Heritability is one of the most important parameters within the breeding context. Heritability points out the direction that how much of the phenotypic variability has a genetic origin, and contributes objective information for the genetic selection process (Falconer, 1981). To improve vegetative yield potentials of leafy vegetables, it is necessary to obtain adequate information on the magnitude and type of genetic variability and their corresponding heritability when it is used to indicate the relative degree by which a character is transmitted from parent to offspring.

Genetic advancement of the metrical character of cultivars which is most vital factor for evaluating any cultivars or genotype of any crop plant. In this context, the vegetative traits have been considered as the crop plant is used as leafy vegetable. The present study was undertaken to estimate the variance components, heritability and genetic advance for its vegetative traits.

MATERIALS AND METHODS

Eight genotypes viz. IC 95609, IC 35482, IC 120617, IC 95597, IC 35626, IC 95595, IC 32190, & IC 95589 of *Amaranthus*sp were procured from National Bureau of Plant Genetic Resources (NBPGR) , New-Delhi, in the month of February, 2011 for their trial performance in this area.These seeds were sown in the research field of the CRF under this department of Botany , The University of Burdwan. The eight accessions were randomly allocated for Randomized block design (RBD) and each was replicated four times. Uniform agronomic measures were provided for their proper growth and development. Different metrical characters such as plant height in 60 days (cm), number of leaves / plant in 60 days, length of petiole in 60 days (cm), leaf width in 60 days (cm), leaf length in 60 days (cm), branch / plant in 90 days and vegetative yield/ plant were recorded.

To estimate the extent of magnitude of variation among these traits, all data
were subjected to analysis of variance. Mean, standard error, range were analyzed according to Singh and Chaudhary (1985). Components of variance $\sigma^2 g$ = genotypic variance, $\sigma^2 p$ = phenotypic variance and $\sigma^2 e$ = error variance were estimated using the following formula of Singh and Chaudhary (1985).

$$\sigma^2_g = MSG - MSE / r$$

$$\sigma^2_p = \sigma^2_g + \sigma^2_e$$

Where as, $\sigma^2_e = MSE$

Where MSG, MSE and *r* are the mean squares of genotypes, mean squares of error and number of replication, respectively.

Phenotypic (PCV) and genotypic (GCV) coefficients of variation were calculated as
the following formula proposed by Singh and Chaudhary (1985) was used:

$PCV = \sigma_p / X \times 100$

$GCV = \sigma_g / X \times 100$

Where,$\sigma_{g,}$ σ_p and *X* are the phenotypic, genotypic standard deviation and grand mean of the traits respectively. Heritability in the broad sense (h^2) was estimates on genotypic mean described by Allard (1999) as:

$h^2 = \sigma^2_g / \sigma^2_p$

Expected genetic advance (GA) and percentage of GA calculated according to Shukla*et al.* (2006).

Expected genetic advance (GA) = i. $\sigma_p . h^2$

GA (%) = GA X 100 /*X*

RESULTS AND DISCUSSION

The leafy vegetable crop was normally harvested after 2/3 weeks of seed sowing in the field. In this case, we started leaf harvesting in 15 days after sowing. The harvesting was performed in different age of crop plant viz. 15 days, 30 days, 60 days and 90 days. The remarkable data on 60 days and 90 days have been considered in this context. Seven metrical vegetative traits were considered for which two- way tables were tabulated for calculating the analysis of variance of each characters. Combined table (table 1) of Analysis of variance for different vegetative traits and component of variances with genetic advance of seven metrical traits of *Amaranthus* sp. have been exhibited in table1.

In all the cases (metrical traits) the df of replication and variety were 7 and 3 respectively. From table 1, it is evident that the value of variance ratio (F value) was significant for variety either in 5% or in 1% except the trait leaf length in 60 days (cm). In case of the metrical characters, the length of petiole, the F value has calculated i.e. 2.79 which were denoted as significant at 55 levels. Normally the F value against replication should not be considered as significant. The estimates of phenotypic coefficients of variation is always higher than genotypic coefficients of variation for all the characters and this indicate high influence of environment on the expression of these traits. Leaf plant^{-1} in 60 days (51.405) and branch number/plant in 90 days (39.115) showed high estimates of GCV revealing that emphasis should be given on these characters during selection of improved genotypes because these characters have high range of genetic variation, hence, a better scope of improvement through selection. Length of petiole in 60 days (18.982) and Leaf width in 60 days (18.657) showed moderate estimates of GCV. With the help of GCV alone, it is not possible to determine the amount of variation that is heritable.

Table1: Analysis of variance for different vegetative traits in amaranth cultivars

Sr. No.	Characters	df	SS	MS	F
1.	Plant height (cm) in 60 days	R- 3 V-7 E-21	531.97 7794.18 8565.66	177.323 1113.454 407.88	0.434^{ns} 2.729*
2	Leaf plant^{-1} in 60 days (number)	R- 3 V-7 E-21	344.7 59748.81 4134.46	114.9 8535.54 196.87	0.5836^{ns} 43.35**
3	Length of petiole(cm) in 60 days	R- 3 V-7 E-21	16.32 49.80 38.4	5.44 7.114 1.828	2.97* 3.89**
4	Leaf width in 60 days (cm)	R- 3 V-7 E-21	6.15 34.59 30.79	2.05 4.94 1.466	1.404 ^{ns} 3.36*
5.	Leaf length in 60 days (cm)	R- 3 V-7 E-21	15.482 84.215 104.883	5.16 12.0 4.9	1.05^{ns} 2.44^{ns}
6	Branch number/ plant in 90 days	R- 3 V-7 E-21	9.105 277.73 25.86	3.035 39.67 1.23	2.46^{ns} 32.25**
7	Vegetative yield/ plant	R- 3 V-7 E-21	241.654 13662.105 4530.229	80.551 1951.729 215.725	0.373^{ns} 9.047**

Where, * and ** significant at 5% and 1% level of significance respectively

Table 2: Estimation of variance components(σ^2_g, σ^2_p) phenotypic (PCV) and genotypic (GCV) coefficients of variation, broad sense heritability(h^2) and genetic advance(GA) (%) for various agronomic traits in amaranth cultivars.

Sr. No.	Characters	σ^2_g	σ^2_p	h^2	PCV	GCV	GA	GA (%)
1.	Plant height (cm) in 60 days	176.39	584.27	0.301	30.074	16.524	15.132	25.627
2.	Leaf plant^{-1} in 60 days (number)	2084.66	2281.53	0.913	53.78	51.405	123.445	139.009
3.	Length of petiole(cm) in 60 days	1.321	3.149	0.419	29.307	18.982	2.104	34.764
4.	Leaf width in 60 days (cm)	0.868	2.932	0.296	34.308	18.657	1.054	28.749
5.	Leaf length in 60 days (cm)	1.775	6.675	0.265	22.423	11.576	1.941	16.873
6.	Branch number/ plant in 90 days	9.69	10.84	0.886	41.377	39.115	8.257	103.783
7.	Vegetative yield/ plant	434.001	649.726	0.667	20.911	17.090	48.130	39.486

The GCV together with heritability estimates would give reliable indication of the expected amount of improvement through selection (Johnson *et al.,* 1955). The heritability (h^2) in all cases have been exhibited (table 2) as desired i.e. within the limit of 1.0. In our case, h^2 value as noted was 0.265 to 0.913. Genetic advance expressed as percentage of mean (using 10% selection intensity) revealed variable behaviour of the traits.

It is worth mentioning that the progenies involved in these combination inherited favourable genes for these traits indicating that the traits are more amenable to selection and could be improved by simple method. The value genetic advance as exhibited in table 2, in the range of 1.05 to 123.44. It is very much remarkable in this case that the GA was 48.13 in case vegetative yield/ plant and 123.44 was against the leaf plant^{-1} in 60 days. Both these metrical traits are no doubt is positively increases of yield in case of this leafy vegetable crop and these characters to be taken into consideration for effective selection in *Amaranthus* sp in a plant breeding programme. GCV, heritability and genetic advance could be effectively used in selection as it suggested by Shukla and Singh (2000) reported for estimation of genetic variability in vegetable amaranth (*A. tricolor*) over different cuttings. Anuja and Mohideen (2007) highlighted the extent of variations on *Amaranthus tricolor, Amaranthus dubias and Amaranthus blitum* by studying heritability and genetic advance.

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