The Pharma Innovation Journal 2023; 12(12): 1411-1416

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(12): 1411-1416

www.thepharmajournal.com
Received: 03-09-2023
Accepted: 05-10-2023

SL Lagad
M.Sc. Students, Department of Genetics and Plant Breeding, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Dr. DK Zate
Assistant Professor, Department of Agriculture Botany, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

YS Borde
M.Sc. Students, Department of Genetics and Plant Breeding, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

VS Chavan
M.Sc. Students, Department of Genetics and Plant Breeding, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Dr. HV Kalpande
Head of Department, Department of Agriculture Botany, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Mohammedi Begum
M.Sc. Students, Department of Genetics and Plant Breeding, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Corresponding Author:
SL Lagad
M.Sc. Students, Department of Genetics and Plant Breeding, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Correlation and path analysis study in grain amaranthus (*Amaranthus hypochondriacus* L.) genotypes

SL Lagad, Dr. DK Zate, YS Borde, VS Chavan, Dr. HV Kalpande and Mohammedi Begum

Abstract

In the present study, correlation and path coefficient analysis carried out for eleven yield and yield contributing traits in 30 germplasm accession of grain amaranth received from NBPGR-New Delhi raised in RBD with 2 replications at experimental research farm, Department of Agril. Botany, VNMKV, Parbhani. during *rabi* 2022-23. In present investigation grain yield per plant has recorded the significant and positive association with days to 50% flowering, days to maturity, plant height, number of spikelets per inflorescence, inflorescence length (cm), inflorescence girth (cm), stem girth (cm), and leaf area per plant (cm2) at both genotypic and phenotypic level. However, negative significant association with 50 ml volume weight (g) and harvest index (%). While, in path analysis, the trait inflorescence girth (0.712) have exerted highest positive direct effect on grain yield followed by inflorescence length (0.213), days to 50 percent flowering (0.156), plant height (0.115), number of spikelets per inflorescence (0.105) and 50 ml volume wt. (0.064) at genotypic level. Whereas, days to maturity (-0.067) exerted highest negative direct effect on grain yield at genotypic level. At phenotypic level, the result of path analysis shown that, the trait inflorescence girth (0.568) have contributed highest positive direct effect on grain yield followed by plant height (0.183), inflorescence length (0.146), days to 50 percent flowering (0.135), leaf area per plant (0.130) and number of spikelets per inflorescence (0.087). It clearly indicates that direct selection would be fruitful based on these characters to increase in grain yield per plant.

Keywords: Path analysis study, grain amaranthus, *Amaranthus hypochondriacus* L., genotypes

Introduction

The genus *Amaranthus*, a member of *Amaranthaceae*, includes a complex array of wild, weedy and domesticated species and consists of approximately 60 species. Amaranthus hypochondriacus, *A. cruentus,* and *A. caudatus* are the primary species planted in India for grain purposes, while *A. tricolor*, *A. dubius*, A. lividus, and A. spinosus are the species grown for vegetables, with *A. viridus* and *A. hybriddus* being grown sporadically (Rana *et al.*, 2005) [12].

They are tall, soft-wooded annuals, extensively grown throughout India for their grain and succulent stem (Aruna *et al.*, 2009) [2]. Due to its tolerance to heat, drought, diseases, and pests as well as the high nutritional content of both its seeds and leaves, amaranthus has been rediscovered as a viable food crop in the last 20 years. It has a high protein content, as well as dietary fiber, minerals, and antioxidants like beta carotene and ascorbic acid.

Correlation analysis is a tool used in plant breeding that helps to select superior genotypes from a diverse genetic populations by providing information on yield components. The correlation studies simply measure the associations between yield and other characters. One way to improve the usefulness of the correlation coefficient information is to partitioning into direct and indirect effects for a set of pairwise cause- effect interactions (Kang *et al.*, 1983) [8].

The correlation coefficient can be divided into direct and indirect effects using path coefficient analysis. It is basically a standardized partial regression analysis and deals with a closed system of variables that are linearly related. This kind of data offers a practical foundation for assigning the appropriate weightage to different yield components. Path coefficient analysis useful for choosing most useful characters to be used for yield improvement through selection. The correlation between various yield characters and their inter relationships were also examined in this study.

Materials and Methods

The research work was carried out at experimental research farm, Department of Agril. Botany, VNMKV, Parbhani. during *rabi* 2022-2023 to study the Genetic diversity, correlation and path analysis study for yield and yield components in grain Amaranthus (*Amaranthus hypochondriacus* L.). Thirty germplasm accession were grown in two replications using a RBD experimental design. Five randomly choosen plants from each accession were used for the recording data on 11 traits *viz,* days to 50% flowering, days to maturity, plant height (cm), number of spikelets per inflorescence, inflorescence length (cm), inflorescence girth (cm), stem girth (cm), leaf area per plant (cm2), harvest index (%), and grain yield per plant (g). In order to investigate the direct and indirect effects of yield component characters on grain yield per plant of grain Amaranth (*Amaranthus hypochondriacus* L.) genotypes, genotypic and phenotypic correlation coefficients were calculated using the formulae proposed by Johnson *et al.,* (1955) [18], and path analysis was performed as suggested by Dewey and Lu (1959) [4].

Results and Discussion

Understanding how characteristics are related to one another is crucial for any crop development programme since it helps to indirect selection. Yield is considered to be a dependent variable on several sub components. In such cases, knowledge of the nature of association between such characters is a great asset for plant breeders to decide the breeding strategies for crop improvement. According to Aruna *et al.* (2009) [2], there is a possibility that yield can be enhanced more successfully if one or more yield components are improved simultaneously.

Correlation coefficient analysis

Genotypic and phenotypic coefficients among eleven yield and yield component traits are presented in table 1 and 2. The correlation studies in the present investigation revealed that the grain yield per plant recorded positive and significant correlation with days to 50 % flowering (G= 0.583**, P= 0.555**), days to maturity (G= 0.448*, P=0.401*), plant height (G= 0.895**, P=0.888**), number of spikelets per inflorescence (G= 0.468*, P=446*), inflorescence length (G= 0.442*, P =0.396*), inflorescence girth (G= 0.950**, P=0.945**), stem girth (G= 0.678**, P= 0.660**), leaf area per plant (G= 0.922**, P= 0.919**) at both genotypic and phenotypic level, respectively. The results revealed that any positive increase in these traits will accelerate the yield potential of grain amaranth. So, these traits should be attracting for selection in grain amaranth breeding programmes. The positive and significant correlations between yield and yield components in grain amaranth were also reported by Shukla and Singh (2002) [13], Aruna *et al.,* (2009) [2], Shukla *et al.,* (2010) [14], Ahammed *et al.,* (2012) [1], Raja *et al.,* (2012) [11], Chattopadhyay *et al.,* (2013) [3], Mahabub *et al.,* (2013) [10], Hasan *et al.,* (2013) [6], Khurana *et al.,* (2013) [9], Dhangrah *et al.,* (2015) [5] and Gerrano *et al.,* (2015) [7]. However, there was a significant negative correlation between yield and 50 ml volume weight (g) (G= -0.514**, P= -0.391*) harvest index (G= -0.287*, P= -0.277*) at genotypic and phenotypic level respectively.

Path coefficient analysis

Correlation coefficients indicate only the general association between any two traits without possible causes of such association. Path coefficient analysis is a valuable tool for assessing the degree of relationship between yield and yield components and provides a clear understanding of the cause and effect relationships among different characters. Therefore, the path coefficient analysis was performed to partition the correlation coefficient into direct and indirect effect of different characters on grain yield.

The data pertaining to path coefficient analysis are presented in table 3. The result of path analysis of 30 germplasm accession in *Amaranthus* revealed that, the trait inflorescence girth (0.712) have exerted highest positive direct effect on grain yield followed by inflorescence length (0.213), days to 50 percent flowering (0.156), plant height (0.115), number of spikelet's per inflorescence (0.105) and 50 ml volume wt. (0.064) at genotypic level. Whereas, days to maturity (-0.067) exerted highest negative direct effect on grain yield followed by stem girth (0.007) at genotypic level.

And at phenotypic level, the result of path analysis in 30 genotypes of *Amaranthus* for eleven character have shown that, the trait inflorescence girth (0.568) have contributed highest positive direct effect on grain yield followed plant height (0.183), inflorescence length (0.146), days to 50 percent flowering, leaf area per plant (0.130) and number of spikelets per inflorescence (0.087). These traits also had maximum significant and positive correlation with yield, direct selection for these traits will be effective to improve yield of grain amaranth.

The data revealed that highest positive indirect effect of all the traits i.e. Days to 50% flowering (0.399), days to maturity (0.310), plant height (0.629), number of spikelets per inflorescences (0.304), inflorescences length (0.169), stem girth (0.494), leaf area per plant (0.639) *via* inflorescence girth on grain yield. Whereas, for the characters 50 ml volume grain weight (0.027) and harvest index (0.019) *via* days to maturity. And highest negative indirect effect of all the traits i.e. days to 50 % flowering, days maturity, plant height, number of spikelets per inflorescence, inflorescence girth, inflorescence length, stem girth, leaf area per plant and 50 ml volume grain weight *via* harvest index on grain yield.

These findings were in conformity with the results of Aruna *et al.,* (2009) [2], Chattopadhyay *et al.,* (2013) [3] and Suryawanshi (2003) reported low positive direct effect of leaf area per plant on grain yield and its association with grain yield was significantly positive. It had positive indirect effect *via* inflorescence length, number of spikelets per inflorescence. Hasan *et al.,* (2013) [6]. Venkatesh (2014) [17] reported similar results for stem girth.

Table 1: Genotypic correlation coefficient analysis in thirty genotypes of *Amaranthus*.

	Days To 50% Flowering	**Days To Maturity**	**Plant Height**	**No. of Spikelet Per Inflorescence**	**Inflorescence Length**	**Inflorescence Girth**	**Stem Girth**	**Leaf Area Per Plant**	**50 ml Volume Seed Weight**	**Harvest Index**	**Grain Yield Per Plant**
Days To 50% Flowering	1.000	0.897**	0.546**	0.114*	0.144*	0.560**	0.546**	0.476**	-0.377*	-0.234*	0.583**
Days To Maturity		1.000	0.394*	0.124*	0.132*	0.435*	0.486**	0.346*	-0.410*	-0.277*	0.448*
Plant Height			1.000	0.263*	0.391*	0.883**	0.663**	0.823**	-0.540**	-0.162*	0.895**
No. Of Spikelet Per Inflorescence				1.000	0.097	0.427*	0.364*	0.472*	-0.172*	-0.291*	0.468*
Inflorescence Length					1.000	0.238*	0.118*	0.469*	-0.303*	-0.302*	0.442*
Inflorescence Girth						1.000	0.693**	0.896**	-0.549**	-0.228*	0.950**
Stem Girth							1.000	0.589**	-0.238*	-0.433*	0.678**
Leaf Area Per Plant								1.000	-0.500**	-0.311*	0.922**
50 ml Volume Seed Weight									1.000	0.153*	-0.514**
Harvest Index										1.000	-0.287*

*, ** denotes significance at 5% and 1% respectively.

Table 2: Phenotypic correlation coefficient analysis in thirty genotypes of *Amaranthus*.

	Days To 50% Flowering	**Days To Maturity**	**Plant Height**	**No. of Spikelet Per Inflorescence**	**Inflorescence Length**	**Inflorescence Girth**	**Stem Girth**	**Leaf Area Per Plant**	**50 ml Volume Seed Weight**	**Harvest Index**	**Grain Yield Per Plant**
Days To 50% Flowering	1.000	0.881**	0.505**	0.115*	0.155*	0.536**	0.526**	0.459*	-0.316*	-0.204*	0.555**
Days To Maturity		1.000	0.336*	0.118*	0.162*	0.395*	0.440*	0.315*	-0.335*	-0.226*	0.401*
Plant Height			1.000	0.239*	0.323*	0.874**	0.639**	0.815**	-0.422*	-0.160*	0.888**
No. of Spikelet Per Inflorescence				1.000	0.098	0.414*	0.337*	0.453*	-0.118*	-0.278*	0.446*
Inflorescence Length					1.000	0.211*	0.124*	0.417*	-0.147*	-0.252*	0.396*
Inflorescence Girth						1.000	0.671**	0.894**	-0.421*	-0.223*	0.945**
Stem Girth							1.000	0.574**	-0.128*	-0.407*	0.660**
Leaf Area Per Plant								1.000	-0.387*	-0.304*	0.919**
50 ml Volume Seed Weight									1.000	0.117*	-0.391*
Harvest Index										1.000	-0.277*

*, ** denotes significance at 5% and 1% respectively.

Table 3: Direct and indirect effects at genotypic level of yield components on grain yield in *Amaranthus*.

	Days To 50% Flowering	**Days To Maturity**	**Plant Height**	**No. of Spikelet Per Inflorescence**	**Inflorescence Length**	**Inflorescence Girth**	**Stem Girth**	**Leaf Area Per Plant**	**50 ml Volume Seed Weight**	**Harvest Index**	**Grain Yield Per Plant**
Days To 50% Flowering	0.156	-0.060	0.063	0.012	0.031	0.399	-0.004	0.012	-0.024	-0.001	0.583**
Days To Maturity	0.140	-0.067	0.045	0.013	0.028	0.310	-0.003	0.009	-0.026	-0.001	0.448*
Plant Height	0.085	-0.026	0.115	0.028	0.083	0.629	-0.004	0.021	-0.035	0.000	0.895**
No. of Spikelet Per Inflorescence	0.018	-0.008	0.030	0.105	0.021	0.304	-0.002	0.012	-0.011	-0.001	0.468*
Inflorescence Length	0.022	-0.009	0.045	0.010	0.213	0.169	-0.001	0.012	-0.019	-0.001	0.442*
Inflorescence Girth	0.087	-0.029	0.101	0.045	0.051	0.712	-0.005	0.023	-0.035	-0.001	0.950**
Stem Girth	0.085	-0.033	0.076	0.038	0.025	0.494	-0.007	0.015	-0.015	-0.001	0.678**
Leaf Area Per Plant	0.074	-0.023	0.095	0.050	0.100	0.639	-0.004	0.025	-0.032	-0.001	0.922**
50 ml Volume Seed Weight	-0.059	0.027	-0.062	-0.018	-0.065	-0.391	0.002	-0.013	0.064	0.000	-0.514**
Harvest Index	-0.036	0.019	-0.019	-0.031	-0.064	-0.162	0.003	-0.008	0.010	0.002	-0.287*

*Significant at 5 percent level, **Significant at 1 percent level.
R = 0.176

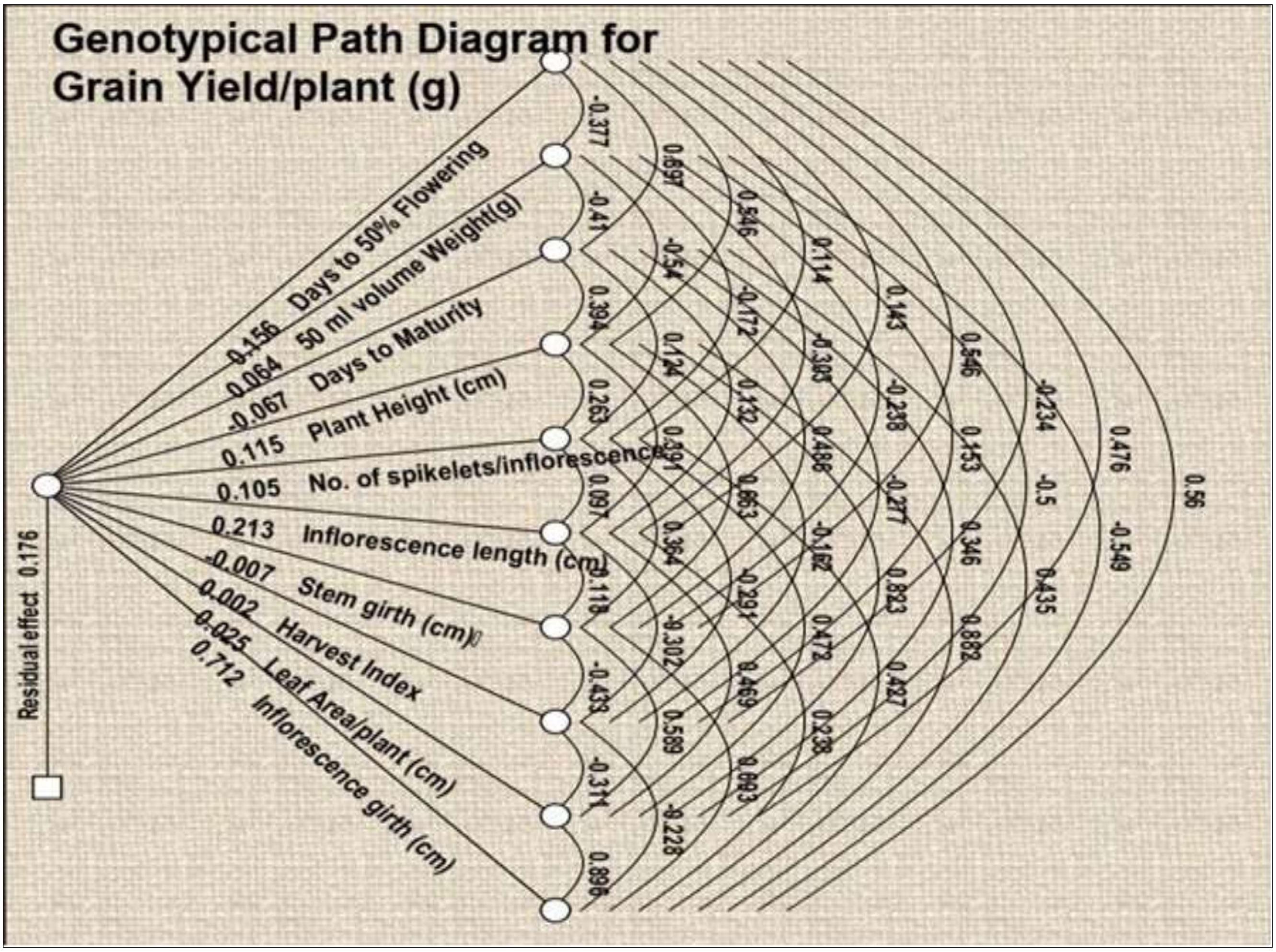

Fig 1: Genotypical path diagram for grain yield per plant (g)

Table 4: Direct and indirect effects at phenotypic level of yield components on grain yield in *Amaranthus.*

	Days to 50% flowering	Days to maturity	Plant height	No. of spikelet per inflorescence	Inflorescence length	Inflorescence girth	Stem girth	Leaf Area per plant	50 ml volume Seed Weight	Harvest Index	Grain yield per plant
Days To 50% Flowering	0.135	-0.063	0.092	0.010	0.023	0.305	-0.001	0.060	-0.009	0.003	0.555**
Days To Maturity	0.119	-0.071	0.062	0.010	0.024	0.224	-0.001	0.041	-0.009	0.003	0.401*
Plant Height	0.068	-0.024	0.183	0.021	0.047	0.496	-0.001	0.106	-0.012	0.002	0.887**
No. Of Spikelet Inflorescence	0.015	-0.009	0.044	0.087	0.014	0.235	0.000	0.059	-0.003	0.004	0.446*
Inflorescence Length	0.021	-0.012	0.059	0.009	0.146	0.120	0.000	0.054	-0.004	0.003	0.397*
Inflorescence Girth	0.072	-0.028	0.160	0.036	0.031	0.568	-0.001	0.117	-0.012	0.003	0.946**
Stem Girth	0.071	-0.031	0.117	0.030	0.018	0.381	-0.001	0.075	-0.004	0.005	0.661**
Leaf Area Per Plant	0.062	-0.022	0.149	0.040	0.061	0.508	-0.001	0.130	-0.011	0.004	0.920**
50 Ml Volume Seed Weight	-0.043	0.024	-0.077	-0.010	-0.022	-0.239	0.000	-0.050	0.027	-0.001	-0.391*
Harvest Index	-0.028	0.016	-0.029	-0.024	-0.037	-0.127	0.001	-0.040	0.003	-0.012	-0.277*

*Significant at 5 percent level, **Significant at 1 percent level.
R = 0.214

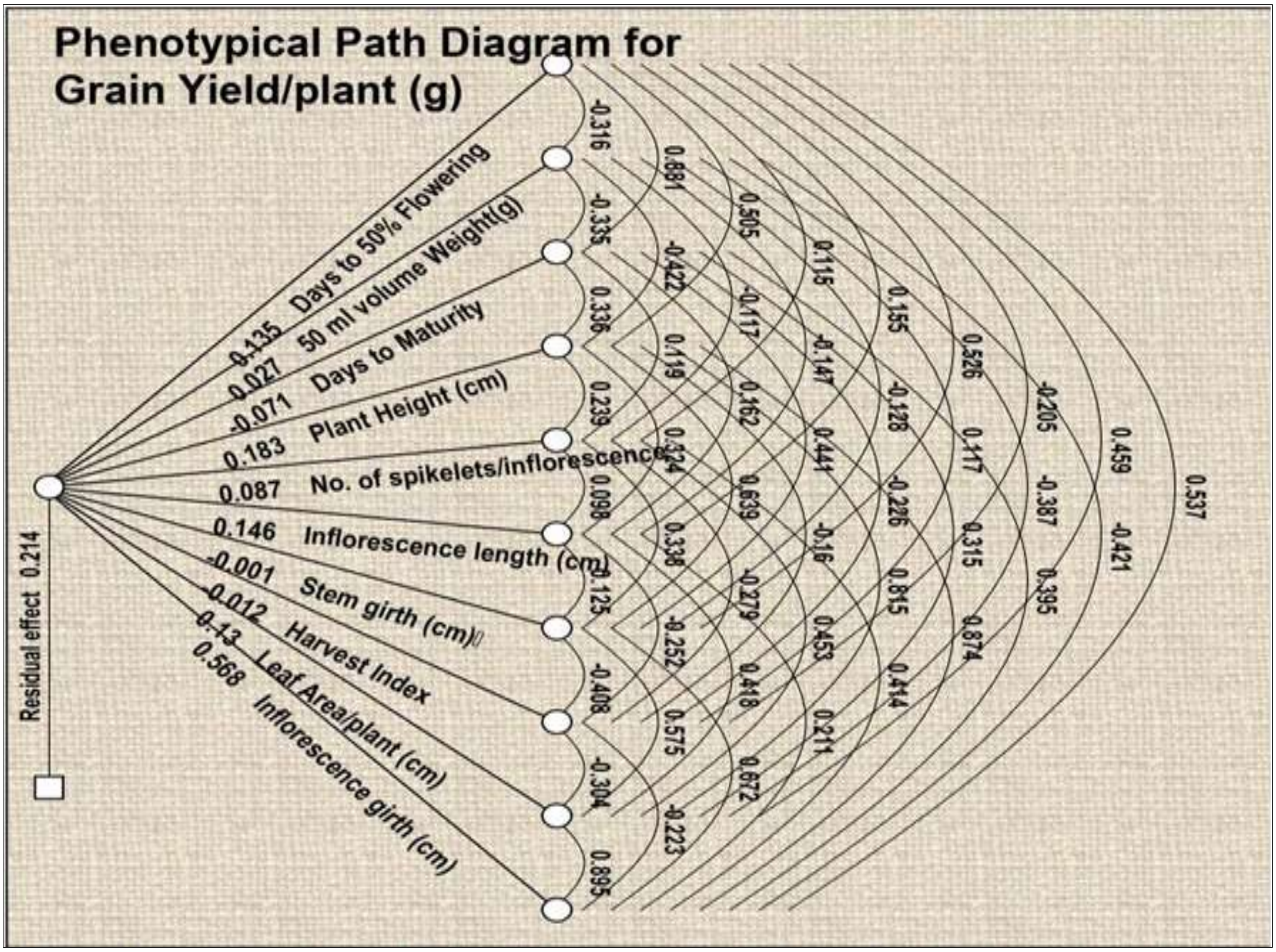

Fig 2: Phenotypical path digram for grain yield per plant (g)

Conclusion

The findings of the path coefficient and correlation analysis conclusively show that the most crucial characteristic for raising grain amaranth yield was inflorescence girth. Also, inflorescence length, plant height, days to 50% flowering, number of spikelets per inflorescence was important yield components in grain amaranth. The inflorescence girth trait has the highest positive direct influence across all traits, while the trait harvest index has a highest negative direct effect at both the genotypic and phenotypic levels. And highest positive indirect effect of all the traits *via* inflorescence girth on grain yield. Thus, the present study suggests that all these traits should be considered simultaneously in selection programme aimed at improving of grain amaranth varieties with high yielding (higher yields). Residual effect was negligible at genotypic (0.176) and phenotypic (0.214) level. Hence most of the yield and yield contributing character included in the study.

References

1. Ahammed AU, Rahman MM, Mian MAK. Multivariate analysis in stem amaranth. Bangladesh Journal of Plant Breeding and Genetics. 2013;26 (1):11-17.
2. Aruna P. Correlation and path analysis in amaranthus. The Asian Journal of Horticulture. 2009;4(2):361-363.
3. Chattopadhyay A, Das S, Rana PN, Seth T, Dutta S. Estimation of genetic parameters, inter-relationships and genetic divergence of vegetable amaranths. International Journal of Plant Breeding. 2013;7(2):111-115.
4. Dewey DR, Lu HK. A correlation and path-coefficient analysis of components of crested wheat grass production. Agronomy Journal. 1959;51:515-518.
5. Dhangrah VK, Mandal J, Bhat JS. Heritable variation and predicted selection response on green yield and its component traits in vegetable amaranth. International Journal of Bio-Resource, Environment and Agricultural Sciences (IJBEAS). 2015;1(4):146-153.
6. Hasan M, Akther CA, Raihan MS. Genetic variability, correlation and path analysis in stem amaranth (*Amaranthus tricolor* L.) genotypes. A Scientific Journal of Krishi Foundation. 2013;11(1):1-7.
7. Gerrano AS, Rensburg WSJV, Adebola PO. Genetic diversity of amaranthus species in South Africa. *South* Afrrican Journal of Plant and Soil. 2015;32(1):39-46.
8. Kang MS, Miller JD, Tai PP. Genetic and phenotypic path analyses and heritability in sugarcane. Crop Science. 1983;23:643-647.
9. Khurana DS, Singh J, Kaur B. Genetic variability, correlation and path coefficient analysis in amaranthus. Vegetable Science. 2013;40(2):238-240.
10. Mahabub MAR. Morphological characterization and yield of forty nine stem amaranth germplasm. M.Sc (Horticulture) thesis submitted to Bangladesh Agricultural University, Mymensingh; c2013.
11. Raja S, Arjun L, Jaime A, Teixeira DS, More TA. Diversity analysis of fleshy leaf type amaranthus for

semi-arid ecosystems. International Journal of Plant Breeding. 2012;6(1):27-33.

12. Rana, JC, Yadav SK, Mandal, Yadav S. Genetic divergence and interrelationship analysis in grain amaranth (*Amaranthus hypochondriacus* L.) germplasm. Indian Journal of Genetics and Plant Breeding. 2005;65(2):99-102.
13. Shukla S, Singh SP. Genetic divergence in amaranth (*Amaranthus hypochondriacus* L.). Indian Journal of Genetics and Plant Breeding. 2002;62(4):336-337.
14. Shukla S, Bhargava A, Chatterjee A, Pandey AC, Mishra BK. Diversity in phenotypic and nutritional traits in vegetable amaranth (*Amaranthus tricolor* L.), a nutritionally underutilized crop. Journal of the Science of Food and Agriculture. 2010;90(1):139-144.
15. Suryawanshi NV. Path analysis and genetic diversity in grain Amaranthus (*A. hypochondriacus*) M. Sc. (Agri.) thesis submitted to MPKV, Rahuri; c2003.
16. Tejaswini NK, Ravinder Reddy P, Saidaiah, Ramesh T. Correlation and Path Coefficient Analysis in Vegetable Amaranth (*Amaranthus tricolor* L.) Genotypes. Int. J Curr. Microbiol. App. Sci. 2017;6(6):2977-2996. DOI
17. Venkatesh L, Niranjana M, Nehru SD. Character association and path co- efficient analysis for various traits in grain amaranth (*Amaranthus* spp.). Asian Journal of Bio Science. 2014;9(1):97-100.
18. Johnson HW, Robinson HF, Comstock RE. Estimates of genetic and environmental variability in soybeans 1. Agronomy journal. 1955 Jul;47(7):314-318.