

SELECTION OF IMPORTANT YIELD COMPONENT CHARACTERS BASED ON GENETIC ANALYSIS IN CELERY (*APIUM GRAVEOLENS* L.)

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Abstract: Eleven genotypes (control and ten macromutants- maintained over generations through selfing) of Celery (*Apium graveolens* L.) are assessed based on eight phenotypic traits (plant height, number of primary branches/plant, total branches/plant, number of compound umbels/plant, number of umbels/plant, number of umbellets of first inflorescence, total seed yield and harvest index) for selection of essential trait(s) maximizing yield through efficient breeding. ANOVA depict variations among the selected traits. Phenotypic and genotypic co-variance, heritability (broad sense) and genetic gain (5% level) performed reveal three important selection indices (total branches, no. of compound umbel and total umbel per plant) in celery.

Keywords: Celery, Germplasms, Quantitative traits, Selection

INTRODUCTION

Celery (*Apium graveolens* L., Family – Umbelliferae; 2n=22), is an important seed spice of India, besides possessing immense therapeutic significance (Ashburn and Stats, 1999; Guerrero, 2005; Praveen, 2011; Fazal and Single, 2012). The spice is providing considerable source in National economy (Khinvasara and Bhushan, 2015) and therefore it should be under sustainable cultivation for enhancement of production in yield and value added products. Ten true breeding mutant lines are raised in celery (total plants screened - 515), which highlights breeding endeavour for improvement. Further, more knowledge of heritability (Rajput and Singh, 2003; Sabesan *et al.*, 2009; Yadava *et al.*, 2011) and genetic gain (Dhayal *et al.*, 1999; Singh *et al.*, 2003; Yadav *et al.*, 2013; Meena *et al.*, 2014) can also shed light on selection of essential traits under study. With the view to it, present investigation estimate genetic variability, heritability and genetic advance for eight yield and yield related traits in eleven (control and macromutants) germplasms of celery.

MATERIAL AND METHOD

In an induced mutagenesis (γ -irradiations and EMS) programme, eleven germplasms that were maintained through selfing are assessed quantitatively based on eight phenotypic traits (plant height, number of primary branches/plant, total branches/plant, number of compound umbels/plant, number of umbels/plant, number of umbellets of first inflorescence, total seed yield and harvest index). ANOVA is performed to estimate variation among the parameters;

Phenotypic and genotypic co-variance, heritability (broad sense) and genetic gain (5% level) are determined for each quantitative trait in the germplasms in accordance to Burton and De Vene (1953), Hanson *et al.* (1956) and Johnson *et al.* (1955a) respectively.

RESULT AND DISCUSSION

Analysis of variance (F-test) reveal that mean sum of square due to variance is significant for all the traits (Table 1), suggesting variations among the plant types. The extent of variability measured in terms of grand mean, PCV, GCV, heritability and genetic gain as per cent of mean are given in Table 2. The estimates of genetic parameters show that the difference between genotypic (GCV) and phenotypic (PCV) co-efficient of variation is low only for plant height, indicating that this character is least affected by environment. For other traits, the differences are much inflated, thereby, depicting a positive role of environment on the expression of genotypes. Co-efficient of variability (%) both at phenotypic and genotypic level are high for total branches/plant, number of compound umbels/plant, number of umbels/plant and seed yield.

High estimate of heritability is obtained for all traits excepting for no. of umbellets of first inflorescence and harvest index. Rawat *et al.* (2013) in their experiment with 12 quantitative characters in 13 diverse genotypes of fennel got high heritability for different traits and opined genetic influence rather than environmental influence in control of the attributes.

High values of co-efficient of variation accompanied with high heritability do not mean that character

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(seed yield, no. of primary branches per plant and to an extent harvest index) will show always high genetic advance. Johnson *et al.* (1955a), Mishra *et al.* (2006), Meena *et al.* (2013) and many others suggested that high heritability in association with high genetic advance is more reliable for selection. In the present investigation, high heritability is coupled with high genetic gain was estimated for total branches, no. of compound

umbels and total umbels per plant. These three traits also exhibit high grand mean in the population. Estimates of heritability also give some idea about the gene action involved in the various polygenetic traits (Johnson *et al.*, 1955b). Panes (1957) reported that association of high heritability with high genetic gain is due to additive gene effect. So, it can infer that the said traits are under additive gene effects.

Table 1. Analysis of variance for different characters in control and mutant plant types.

Sources	DF	Mean Sum of Squares (M.S.S) of quantitative traits (T)							
		T-1	T-2	T-3	T-4	T-5	T-6	T-7	T-8
Treatments	10	1237.87**	33.75**	67573.09**	64823.38**	947646.21**	171.01**	22.01**	92.59**
Error	54	75.40	3.27	6653.76	6479.26	90150.74	87.96	2.09	20.07

** = significant at 1% level.

T-1= Plant height (cm), T-2= No. of primary branches/plant, T-3= Total branches/plant, T- 4= No. of compound umbels/plant, T-5= No. of umbels/plant, T-6= No. of umbellets of first inflorescence, T-7= Seed yield (gm) and T-8= Harvest index (%).

Table 2. Analysis of genetic parameters for different traits in 11 germplasms.

Variable	Grand mean	Genotypic variance	Environmental variance	Phenotypic variance	Co-efficient of variability (%)		Heritability	Genetic gain as % of mean
					GCV	PCV		
Plant height (cm)	74.62	211.58	79.13	290.71	19.49	22.85	73.0	25.56
No. of primary branches/plant	8.75	5.56	3.35	8.91	26.95	34.11	62.0	3.84
Total branches/plant	177.14	10888.48	7069.60	17958.08	58.91	75.65	61.0	167.38
No. of compound umbels/plant	169.55	10383.98	6883.63	17267.61	60.10	77.50	60.0	162.79
No. of umbels/plant	692.52	153165.60	96133.10	249298.70	56.51	72.10	61.0	631.93
No. of umbellets of first inflorescence	34.86	16.22	87.71	103.93	11.55	29.24	16.0	3.28
Seed yield (gm)	2.68	3.47	2.25	5.72	69.64	89.41	61.0	2.99
Harvest index (%)	18.24	12.50	19.83	32.33	19.38	31.17	39.0	4.53

CONCLUSION

Traits namely total branches, no. of compound umbels and total umbels per plant showing high heritability coupled with high genetic gain can be considered effective for selection and improvement in celery.

REFERENCES

- Ashburn, M.A. and Stats, P.S.** (1999). Management of chronic pain. *The Lancet*, **353**: 1865-1869.
- Burton, G.W. and De Vene, E.H.** (1953). Estimating heritability in tall fescue (*Festuca arundinacea*) from replicated clonal material. *Agronomy Journal*, **45**: 478-481.
- Dhayal, L.S.; Bhargava, S.C. and Mahala, S.C.** (1999). Studies on variability in cumin (*Cuminum cyminum* L.) on normal and saline soil. *Journal of Spices and Aromatic Crops*, **8**(2): 197-199.
- Fazal, S.S. and Single, R.K.** (2012). Review on the pharmacognostical and pharmacological characterization of *Apium graveolens* Linn. *Indo Global Journal of Pharmaceutical Science*, **2**(1): 36-42.
- Guerrero, J.A.** (2005). Flavonoids inhibit platelet function through binding to the thromboxane A2 receptor. *Journal of Thrombosis and Haemostasis*, **3**(2): 369-376.
- Hanson, G.H.; Robinson, H.F. and Comstock, R.E.** (1956). Biometrical studies of yield in segregating population of Korean lespezea. *Agronomy Journal*, **40**: 260-271.
- Johnson, H.W.; Robinson, H.F. and Comstock, R.E.** (1955a). Estimates of genetic and environmental variability in Soybeans. *Agronomy Journal*, **46**: 314-318.
- Johnson, H.W.; Robinson, H.F. and Comstock, R.E.** (1955b). Genotypic and phenotypic correlations in Soybeans and their implications in selection. *Agronomy Journal*, **47**: 477-483.
- Khinvasara, S. and Bhushan, P.** (2015). Seed Spices Production in Rajasthan— An Overview. Professional Panorama: An International Journal of Management and Technology, 15-26. Available from: <http://www.professionalpanorama.in/wp-content/uploads/2015/11/2-padam.pdf>.
- Meena, Y.K.; Jadhao, B.J. and Kale, V.S.** (2013). Genetic variability, heritability and genetic advance in coriander. *Agriculture for sustainable development*, **1**(1): 31-33.
- Meena, Y.K.; Jadhao, B.J. and Kale, V.S.** (2014). Genetic analysis of agronomic traits in Coriander. *SABRAO Journal of Breeding and Genetics*, **46**(2): 265-273.
- Mishra, A.C.; Singh, N.P.; Kamal, S. and Kumar, V.** (2006). Studies on genetic variability and genetic advance in Potato (*Solanum tuberosum* L.). *International Journal of Plant Science*, **1**(1): 39-41.
- Panes, V.G.** (1957). Genetics of quantitative characters in relation to plant breeding. *Indian Journal of Genetics*, **17**: 318-328.
- Praveen, N.** (2011). In-vitro antioxidant activity, total phenolics and flavonoids from celery (*Apium graveolens*) leaves. *Journal of Medicinal Plants Research*, **5**(32): 7022-7030.
- Rajput, S.S. and Singh, D.** (2003). Variability in coriander (*Coriandrum sativum* L.) for yield and yield components. *Journal of Spices and Aromatic Crops*, **12**(2): 162-164.
- Rawat, S.K.; Kumar, S. and Yadav, Y.C.** (2013). Genetic evaluation for biometrical traits in fennel (*Foeniculum vulgare* Mill.). *Journal of Spices and Aromatic Crops*, **22**(1): 85-87.
- Sabesan, T.; Suresh, R. and Saravanan, K.** (2009). Genetic variability and correlation for yield and grain quality characters of rice grown in coastal saline low land of Tamilnadu. *Electronic Journal of Plant Breeding*, **1**: 56-59.
- Singh, Y.; Mittal, R. and Katoch, V.** (2003). Genetic variability and heritability in turmeric (*Curcuma longa* L.). *Himachal Journal of Agricultural Research*, **29**(1&2): 31-34.
- Yadav, P.S.; Pandey, V.P. and Yadav, Y.** (2013). Variability studies in fennel (*Foeniculum vulgare* Mill.). *Journal of spices and Aromatic Crops*, **22**(2): 203-208.
- Yadava, D.K.; Giri, S.C.; Vignesh, M.; Vasudev, S.; Yadav, A.K. et al.** (2011). Genetic variability and trait association studies in Indian mustard (*Brassica juncea*). *Indian Journal of Agricultural Sciences*, **81**(8): 712-716.

