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Genetic Variability, Heritability and Genetic Advance in Onion (*Allium cepa* var. Cepa L.)

Pravin Kumar Sharma*, Avtar Singh, D. S. Duhan, Naval Kishor and Navjot Singh Barar

Department of Vegetable Science, Chaudhary Charan Singh Haryana Agricultural University, Hisar (Haryana), India

*Corresponding Author E-mail: pravinveg@gmail.com

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ABSTRACT

The present study was aimed at investigating the yield and yield contributing traits in onion in order to generate information regarding the extent of genetic variability, heritability and genetic advance. The experiment was laid under randomized block design replicated thrice at Vegetable Research Farm, Department of Vegetable Science, Chaudhary Charan Singh Haryana Agricultural University, Hisar (Haryana), during 2013-14 and 2014-15 rabi season along with thirty five genotypes (8 sterile line, 3 tester and 24 hybrids). High degree of variation was observed for all the characters studied. The difference between phenotypic (PCV) and genotypic (GCV) coefficient of variation was found to be narrow for most of the traits except bulb weight and neck thickness. The GCV ranged from 1.24 (moisture content of bulb) to 28.32 per cent (number of 'D' grade bulb) while PCV ranged from 1.28 (moisture content of bulb) to 30.95 per cent (number of 'D' grade bulb) for the various characters studied. The high estimates of heritability were found for all the characters studied. Expected genetic advance over mean was observed high for the characters viz numbers of 'D' grade bulb, followed by numbers of 'C' grade bulb, numbers of 'A' grade bulb, marketable bulb yield, total bulb yield and number of leaves per plant, number of 'B' grade bulb and polar diameter of bulb. These characters are therefore governed by additive gene effects. Selection on the basis of these characters will be more useful for the improvement of this crop towards attaining higher yield.

Key words: *Variability; Heritability; Genetic advance; GCV; PCV*

INTRODUCTION

Onion (*Allium cepa* var. cepa L.) is a highly cross-pollinated crop, biennial for seed production and annual for bulb production and belongs to family Alliaceae (2n= 16). It is one of the most important vegetables and is grown worldwide under outdoor conditions. It is an indispensible item in every kitchen as vegetable and condiment used to flavor many of the foodstuffs. In addition onion is used as salad and pickle. Nowadays it is used by processing industries for dehydration in the form of onion flakes and powder which are in great demand in the world market. In the world India ranks first in total area (13.20 lakh hectares) and second in production (209.31 lakh tons) for onion after China.

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The crop accounts for 10.4 per cent share out of total vegetable production in India after tomato[2]. It has become an important commercial crop because of its area, production and consumption. Yield is a complex character; it depends on a number of agronomic traits and is influenced by many factors which could be genetic or environmental[10]. To improve the bulb yield, quality and storability through selection the information on the nature and magnitude of variability for yield and yield contributing characters present in the population owing to its genetic and non-genetic causes plays an important role and as such it is a basic prerequisite for any systematic breeding programme. Thus for improving the efficiency of selection in any base population the knowledge of genetic variability present in it is of prime importance to the breeder. The improvement in any crop is proportional to the magnitude of its genetic variability present in the genotypes[9]. Most of the economic plant characters in onion are polygenic in nature and highly influenced by the environment. To improve the yield through selection of better varieties, knowledge of variability and nature of association of bulb yield with yield contributing characters is very essential. Therefore present field investigation was carried out with a view to study the genetic variability, heritability and genetic advance in onion.

MATERIAL AND METHODS

The present investigation was conducted at Vegetable Research Farm, Department of Vegetable Science, Chaudhary Charan Singh Haryana Agricultural University, Hisar (Haryana), during 2013-14 and 2014-15 *rabi* season long with thirty five genotypes (8 sterile line, 3 tester and 24 hybrids). The experiment was laid out in randomized block design with three replications. The observations were recorded on five plants from each plot at random on plant height (cm), number of leaves per plant, bulb size grades (number & weight basis), diameter of bulb (cm) (polar &equatorial), average bulb weight (g), total bulb yield (q/ha), marketable bulb yield (q/ha), moisture content of bulb (%, Dry matter of bulb (%) and TSS. The data were analyzed to work out variance components and coefficient of variations as per method suggested by Burton[4]. Heritability in broad sense and expected genetic advance as per cent of mean were estimated as suggested by Johnson *et al*[8].

RESULT AND DISCUSSION

The PCV was found to be greater of its GCV for all the characters studied. The results are similar to the findings of Singh *et al*.[11] and Chattopadhyay *et al*[5]. The GCV ranged from 1.24 per cent (moisture content of bulb) to 28.32 per GCV was observed for number of 'D' grade bulb (28.32) fallowed by number of 'C' grade bulbs (23.59) and number of 'A' grade bulbs (22.72). Moderate was observed for characters like plant height (10.00), number of leaves per plant (15.69), numbers of 'B' grade bulb (15.19), diameter of bulbs (polar) (13.16), total bulb yield (18.18) and marketable bulb yield (18.84) and low values of GCV were observed for moisture content of bulb (1.24), total soluble solids of bulb (5.24) and dry matter content of bulb (8.81). Gurjar and Singhania[12] reported low GCV and PCV for plant height and days to maturity. The PCV ranged from 1.28 per cent (moisture content of bulb) to 30.95 per cent (number of 'D' grade bulbs) for the various characters studied. The moderate PCV was recorded for characters like plant height (10.40), number of leaves per plant (16.19), numbers of 'B' grade bulb (15.99), diameter of bulbs (polar) (13.75), total bulb yield (18.21) and marketable bulb yield (18.86). However low values of PCV were observed for for moisture content of bulb (1.28), total soluble solids of bulb (5.59) and dry matter content of bulb (9.04). Hosamani *et al*.[7] reported high value of GCV and PCV for yield per hectare and for average bulb weight, whereas; moderate for all characters except total soluble solids. Exactly not equal but somewhat similar magnitude of GCV and PCV was recorded for all the characters except number of leaves per plant, number of 'B'

grade bulbs and number of 'D' grade bulbs, which indicates the less influence of environment and that the character expressions are totally due to genetic makeup.

As the coefficient of variation indicated only the extent of variability it does not reflect on heritable proportion of variation. Hence estimation of heritability coupled with genetic advance as per cent over mean permits greater effectiveness for selection by separating out the environmental influence from the total variability and thereby allowing accurate selection of a potential phenotype. The heritability estimates in broad sense were high for all the characters. Similar results were reported by Pramode and Gangaprasad[15], Ananthan and Balkrishnamoorthy[1]. The broad sense heritability is ranged from 83.70 (number of 'D' grade bulb) to 99.73 (marketable bulb yield). Very high Heritability was observed for all characters studied. The parameter genetic advance in per cent of mean is a more reliable index for understanding the characters because its estimate is derived by involvement of deviation and intensity of selection. Expected genetic advance in percentage over mean was estimated for different characters and indicated that the expected genetic advance over mean observed was in the range of 2.48 to 53.38 per cent for different characters. It was observed low in case of moisture content of bulb (2.48) and moderate for the characters plant height (19.81) average weight of bulb (18.63), equatorial diameter of bulb (18.46), dry matter content of bulb (17.51) and total soluble solids of bulb (10.14). The values of expected genetic advance in per cent over mean was recorded high for the characters *viz*numbers of 'D' grade bulb (53.38), followed by numbers of 'C' grade bulb (46.69), numbers of 'A' grade bulb (45.38), marketable bulb yield (38.56), total bulb yield (37.40) and number of leaves per plant (31.32), number of 'B' grade bulb (29.73) and polar diameter of bulb (25.95). Hayder *et al.*[13] and Bharti *et al*.[3] also reported high expected genetic advance in percentage over mean for yield per plot, yield per hectare, bulb size and number of leaves per plant. Thus heritability and genetic advance in per cent of mean in combination provide clearer picture regarding the effectiveness of selection for improving the characters.

Table: Estimates of mean performance, range, genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability (broad sense) and genetic advance (GA) for different characters in Onion

Sr. No.	Characters		Mean ± SE	Range		Coefficient of variation		Heritability (b.s.) (%)	Genetic advance as *per cent* of mean
				Minimum	Maximum	GCV (%)	PCV (%)		
1	Plant height (cm)		55.74 ±1.59	40.60	66.50	10.00	10.40	92.50	19.81
2	Number of leaves per plant		8.21±0.33	5.60	10.53	15.69	16.19	93.90	31.32
3	Bulbs size grades (number &weight basis)	A (>70g)	30.67±1.75	18.66	44.33	22.72	23.42	94.00	45.38
		B (40-70g)	53.03±2.64	38.00	68.66	15.19	15.99	90.25	29.73
		C (<40g)	29.47±2.01	17.66	40.33	23.59	24.57	92.24	46.69
		D (D&B)	12.82±1.60	6.00	21.33	28.32	30.95	83.70	53.38
4	Diameter of bulbs (cm)	Polar	4.61 ±0.18	3.48	5.56	13.16	13.75	91.60	25.95
		Equatorial	4.86 ±0.16	3.92	5.87	9.46	10.00	89.60	18.46
5	Average weight of bulb (g)		60.89 ±1.35	50.40	71.98	9.29	9.56	94.60	18.63
6	Total bulb yield (q/ha)		59.02 ±2.46	182.37	344.83	18.18	18.21	99.70	37.40
7	Marketable bulb yield (q/ha)		229.72±2.25	155.01	290.59	18.84	18.86	99.73	38.56
8	Moisture content of bulb (%)		87.59 ±0.28	85.60	89.92	1.24	1.28	93.90	2.48
9	Dry matter content of bulb (%)		12.40 ±0.28	10.08	14.39	8.81	9.04	93.90	17.51
10	Total soluble solids of bulb (%)		12.73 ±0.25	11.30	14.36	5.24	5.59	88.10	10.14

REFERENCES

1. Ananthan, M. and Balkrishnamoorthy, G. Genetic variability and correlation studies in onion (*Allium cepa* var cepa L.) for economic dry matter yield. *Agricultural Science Digest*, **27(3):** 190-193. 75 (2007).
2. Anonymous, National horticulture database. National Horticulture Board, Gurgaon, Haryana, India (2016).
3. Bharti, N., Ram, R.B., Meena, M.L. and Yogita, Genetic variability studies in onion (*Allium cepa* L.). *Annals of Horticulture*, **4 (2):** 171-175 (2012).
4. Burton, G.W., Quantitative inheritance in grasses. *Proceeding, 6th International Grassland Congress*, Pennsylvania State College, 17-23 **1:** 277-283 (1952).
5. Chattopadhyay, A., Sharangi, A.B., Dutta, S., Das, S. and Denre, M., Genetic relatedness between quantitative and qualitative parameters in onion (*Allium cepa* L.). *Vegetos*, **26 (1):** 151-157 (2013).
6. Gurjar, R.S.S. and Singhania, D.L. Genetic variability, correlation and path analysis of yield and yield components in onion. *Indian Journal of Horticulture*, **63 (1):** 53-58 (2006).
7. Hosamani, R.M., Patil, B.C. and Ajjappalavara, P.S. Genetic Variability and character associated studies in onion (*Allium cepa* L.). *Karnataka Journal Agricultural Sciences*, **3 (2):** 302-305 (2010).
8. Johnson, H.W., Robinson, H.F. and Comstock, R.E. Estimates of genetic and environmental variability in soybeans. *Agronomy Journal* **47(7):** 314-318 (1955).
9. Mallor, C., Carravedo, M., Estopanan, G. and Mallor, F. Characterization of genetic resources of onion (*Allium cepa* L.) from the Spanish secondary centre of diversity. *Spanish Journal of Agricultural Research*, **9 (1):** 144-155 (2011).
10. Uddin, M.M., Samad, A., Khan, M.R., Begum, S. and Salam, M.A. Correlation and path analysis of yield and yield contributing characters in Brassica species. *Bangladesh Journal of Agricultural Research*, **10:** 71-75 (1985).
11. Singh, R.K., Dubey, B.K., Bhonde, S.R. and Gupta, R.P. Variability studies for some quantitative characters in white onion (*Allium cepa* L.) advance lines. *Vegetable Science*, **37(1):** 105-107 (2010).
12. Gurjar, R.S.S. and Singhania, D.L., Genetic variability, correlation and path analysis of yield and yield components in onion. *Indian Journal of Horticulture*, **63(1):** 53-58 (2006).
13. Hayder, A., Sharker, N., Ahmed, M.B., Hannan, M.M., Razvy, M.A., Hussain, M., Hoque, A. And Karim, R. Genetic variability and interrelationship in onion (*Allium cepa* L.). *Middle East Journal Science of Research*, **2(3&4):** 132-134 (2007).
14. Hosamani, R.M., Ratil, B.C. and Ajjappalavara, P.S. Genetic variability and character association studies in onion (*Allum cepa* L.). *Karnataka Journal of Agricultural Science*, **23(2):** 302-305 (2010).
15. Pramoda, H.P. and Gangaprasad, S. Biometrical basis of handling segregation population for improving productivity in onion (*Allium cepa* L.). *Journal of Asian Horticulture*, **3(4):** 278-280 (2007).