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Research Article

Assessment of Genetic Variability in Onion (*Allium cepa* L.) Genotypes

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ABSTRACT

Onion (Allium cepa L.) is one of the most valuable vegetable cum spice crop belongs to the family Alliaceae with chromosome number 2n= 16. The genus Allium comprises more than 750 crop species; notably onion, garlic, chives, and leek are widely distributed in the northern temperate and Alpine regions of the world. The existing knowledge about onion genetic diversity and resources is limited or one has to review periodically which helps in the efficient management of germplasm and selection of parents for crossing. Hence the present investigation was carried out with 40 onion genotypes for genetic variability which revealed that the environmental influence was very less on expression of these characters as it was evident by narrow gap between genotypic and phenotypic coefficients of variation. Genotypic and phenotypic coefficients of variation were moderate to high, for all the characters studied except for days to first flowering, days to 50 per cent flowering and TSS. Moderate to high heritability was observed for all characters and high genetic advance as per cent mean indicating that simple selection would be sufficient for these traits to bring genetic improvement.

Keywords: *Heritability, Genetic Advance, Onion.*

INTRODUCTION

Onion (*Allium cepa* L.) is one of the important bulb crop of the family Amaryllidaceae and grown widely all over the world and consumed in various forms. It can be grown under wide range of agro-climate condition. Onion is cultivated mainly as annual for bulb production and biennial for seed production. It is mainly grown for its edible bulb which develops underground. Immature and mature bulb is consumed as vegetable and condiment. Onion has many medicinal values and used for preparation of various Homeopathic, Unani and Ayurvedic medicines.

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Onion consumption lowers the blood sugar (Augusti, 1990). Onion leaves and bulbs are nutritionally rich in minerals like calcium, potash and phosphorus (Ullah et al., 2005). Onion is characterized by its distinctive flavour and pungency which is the due to sulphur containing compounds (Allyl propyl disulphide) found in the scales of bulb. Highly pungent red coloured onions are preferred in India while less pungent yellow or white skinned ones are demanded in European and Japanese market.

Onion accounts for 70 percent of our total foreign exchange earnings from the export of fresh vegetables. Government of India has declared onion as an essential commodity.

Availability of sufficient genetic variability is very important in a crop improvement programme. For successful breeding programme, amount of genetic variability present in the experimental material is a basic requirement. Therefore, it is essential for a plant breeder to measure the variability with the help of parameters like phenotypic coefficient of variation, genotypic coefficient of variation, heritability and genetic advance. Hence, these parameters give the information regarding the availability of genetic variability for different characters in available germplasm. Therefore, study of genetic variability of bulb yield and its component characters among different genotypes provides a strong basis for selection of desirable genotypes for augmentation of yield and other yield attributing characters.

MATERIALS AND METHODS

The present investigation was carried out at Kittur Rani Channama College of Horticulture Arabhavi, which falls under Northern Dry Zone of Karnataka. The experiment was conducted in black soil where, 40 germplasm accessions collected both by local farmer's field and some released varieties from public institution were raised in raised seed beds and transplanted in main fields during August 2016 to September 2016 and August 2017 to September 2017 in randomized block design with two replications consisting of one row of 15 plants for each entry. A spacing of 30 cm × 15 cm was followed and the crop was raised as per the recommended package of practices by UHS, Bagalkot.

The experiment was conducted for two consecutive years and observation recorded for each year were pooled and pooled data was used for analysis using INDOSTAT software. The observations recorded during the experiment are, plant height (in cm), neck thickness (in mm) and number leaves among the growth parameters, days to first and fifty per cent flowering and number of florets per plant among the flowering (earliness) parameters and bulb diameter/bulb equatorial diameter (in cm), bulb length / bulb polar diameter (in cm) and bulb shape index / P. E. (Polar: Equatorial) which was calculated by ratio between polar diameter and equitorial diameter of a bulb, bulb weight (g) and bulb yield per plot (Kg) among the bulb and yield parameters and among the quality parameters chlorophyll (mg/100mg of leaves) content and TSS (˚ brix) were recorded.

RESULTS AND DISCUSSIONS

Mean performance of genotypes

The mean performance and range of the 40 genotypes for all the thirteen characters are presented in the Table 1. The range in mean values, an indicator of variability revealed high variation for bulb yield per hectare, plant height at harvest, average bulb weight and bulb volume.

Growth parameters

In the present study low GCV and PCV were observed for plant height and neck thickness. These, results are in agreement with Yaso (2007) and Hosamani et al. (2010). Narrow difference between GCV and PCV indicated that little environmental effect and may be governed by non additive genes. However number of leaves showed high GCV and PCV and the results are in agreement with those of Yaso (2007), Hosamani et al. (2010) and Porta et al (2014).

High heritability and GAM were observed for plant height where, the results are in line with the Trivedi et al. (2006), Gurjar and Singhania (2006), Dhotre et al. (2010),

Hosamani et al. (2010) and Ram et al. (2011). The high heritability with high GAM estimates for this trait indicated the role of additive genes in governing its expression. Hence, selection on phenotype would be rewarding in improvement of this trait.

Earliness parameters

Days to first flowering and days to 50% flowering had low GCV, PCV and GAM but high heritability. These results are in accordance with Yaso (2007). This indicated that simple selection for improvement of these traits may be helpful.

Bulb characters

Bulb diameter and bulb length had moderate GCV and PCV with high heritability and GAM. These results are in line with Jansi and Thangaraj (2004), Gowda et al. (2004). However in contrast low GCV and PCV with low heritability and moderate GAM was observed for bulb shape index but narrow difference between GCV and PCV indicated that lesser environmental effect and may be governed by non additive genes. This indicated that simple selection will be helpful in improvement of this trait.

Yield parameters

High GCV, PCV, heritability and GAM was observed for individual bulb weight. This result is in accordance with Patil et al. (2006), Hayder et al. (2007), Hosamani et al. (2010), Singh et al. (2010), Ram et al. (2011) and Ibrahim et al. (2013). This indicated presence of additive gene effect for individual bulb weight, thus simple selection will be helpful. However yield is a complex character which cannot lead success in direct selection based on it. So characters associated and contributable for this character must be studied after which selection will be promising.

Quality parameters

High estimates of GCV, PCV, heritability and GAM were observed for chlorophyll content. This result is compliance with earlier worker Trivedi et al. (2006a), Gurjar and Singhania (2006), Yaso (2007), Dhotre et al. (2010). This suggested that simple selection might improve the trait.

TSS recorded low GCV and PCV, but high heritability and moderate GAM. This result was in line with values obtained by earlier worker Gurjar and Singhania (2006), Yaso (2007), Dhotre et al. (2010). This suggests that preponderance of additive gene, so selection will be rewarding for improvement of this trait.

Table 1: Different genetic parameters for quantitative and qualitative traits in onion germplasm

Sl. No.	Characters	Mean	Range	Genotypic variance	Phenotypic variance	Genotypic coefficient of variance (GCV in %)	Phenotypic coefficient of variance (PCV in %)	Heritability (h^2 in %)	Genetic Advance (GA) at 5%	Genetic Advance as per cent mean (GAM %) at 5%
1	Plant height (cm)	43.89	22.8-64	42.97	71.89	14.93	19.32	59.80	10.44	23.78
2	Number of leaves	7.65	3.50-13.00	1.96	4.60	18.29	28.02	42.60	1.88	24.59
3	Neck thickness (mm)	13.98	6.25-23.06	4.94	10.01	15.90	22.62	49.40	3.22	23.02
4	Days to first flowering	53.13	42.00-66.50	11.56	19.63	6.40	8.34	58.90	5.38	10.12
5	Days to 50 per cent flowering	75.13	64.00-89.50	10.88	21.00	4.39	6.10	51.80	4.89	6.51
6	Number of florets per plant	256.17	69.50-814.50	15870.85	20079.41	49.18	55.32	79.00	230.72	90.07
7	Bulb diameter (cm)	3.84	2.24-6.05	0.48	0.72	18.05	22.03	67.10	1.17	30.45
8	Bulb length (cm)	4.52	2.40-6.60	0.43	0.87	14.59	20.59	50.20	0.96	21.29
9	Bulb shape index	1.25	0.54-2.35	0.06	0.13	20.06	28.34	50.10	0.37	29.25
10	Individual bulb weight (g)	97.26	15.50-210.31	939.59	1555.21	31.52	40.55	60.40	49.08	50.46
11	Bulb weight per plot (Kg)	45.15	24.00-66.00	43.40	86.45	14.59	20.59	50.20	9.61	21.29
12	Chlorophyll content (mg/100g)	21.45	5.29-26.19	16.71	21.32	19.05	21.52	78.40	7.45	34.74
13	TSS (%)	11.07	9.65-15.05	0.62	0.84	7.11	8.28	73.60	1.39	12.56

CONCLUSION

Analysis of variance revealed highly significant difference among the accessions for all the characters studied. Environmental influence was very less on expression of these characters as it was evident by narrow gap between genotypic and phenotypic coefficients of variation. Genotypic and phenotypic coefficients of variation were moderate to high, for all the characters studied except for days to first flowering, days to 50 per cent flowering and TSS. Moderate to high heritability was observed for all characters and high genetic advance as per cent mean indicating that simple selection would be sufficient for these traits to bring genetic improvement.

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