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Variability Studies in F_2 Population of Tomato (*Solanum lycopersicum* L.) for Yield and Other Economic Traits

Mamatha, N. C.*, Lingaiah, H. B. and Jyoti, H. K.

Department of Vegetable Science, College of Horticulture, UHS campus, GKVK (PO), Bengaluru-560 065

*Corresponding Author E-mail: mamatha.hortico@gmail.com

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ABSTRACT

A study was conducted to find out the genetic variability in F_2 population of cross Utkal Raja x Arka Sourabh. Higher estimates of PCV and GCV were observed for the traits like plant height, number of branches at peak harvest stage, number of clusters per plant, days to first flowering, number of fruits per plant, average fruit weight and yield per plant. For traits like TSS and total acidity the estimates of PCV and GCV were found moderate. Higher heritability coupled with high genetic advance as per cent mean were observed for plant height, number of clusters per plant, days to first flowering, number of fruits per plant, average fruit weight, yield per plant and total acidity indicates the predominance of additive gene component. Thus, there is much scope for improving these characters by simple selection in further generations.

Key words: *Tomato, Variability, PCV, GCV, F_2 population, Yield.*

INTRODUCTION

Tomato (*Solanum lycopersicum* L.) having chromosomal number 2n=24 belongs to family Solanacea, is native to Peru Equador region. Tomato is rich in vitamin A and also a major source of lycopene which is a potent antioxidant. It is a versatile vegetable for culinary purpose and can be utilized in range of products. Tomato is a typical day neutral plant and is a warm season crop, which is resistant to heat and drought. Because of its importance it is the second most vegetable grown in India after potato with an area of 8.82 lakh hectare and 187.35 lakh tonnes of annual production[1].

The success of any crop improvement program largely dependent on the substantial magnitude of variability in the population. Greater the diversity in the material better are the chances for evolving promising and desired genotypes. The phenotypic expression of the plant is mainly controlled by the genetic makeup of the plant and the environment where it is growing. To understand the extent to which the observed variations are due to genetic factors, genetic variability estimates including genotype mean, genotypic and phenotypic coefficient of variation, heritability and genetic advance over mean.

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MATERIALS AND METHODS

The experiment was carried out at the Department of Vegetable Science, College of Horticulture, UHS Campus, GKVK (PO), Bengaluru, during the year 2012-13. The plant material used in the investigation is F_2 population of the cross Utkal Raja x Arka Sourabh, obtained by selfing in previous generation during which performed best for yield and other economic traits among other hybrids. The seeds were first sown in protrays then transplanted to main field after twenty eight days of sowing. The seedlings were planted at the spacing of 90 cm (between the ridges) and 45 cm (between the plants). The recommended package of practices for the crop was followed time to time during the crop season. The data was recorded for nine traits from all the plants tagged.

RESULTS AND DISCUSSION

The results are presented in **Table 1**. The mean plant height at peak harvest stage was 57.82cm and it ranged from 15cm to 110cm. This showed that there was much of the variation observed in F_2 of the cross Utkal Raja x Arka Sourabh. PCV and GCV were high for plant height at peak harvest stage indicating that there was broad genetic variability for this character. The plant height exhibited high heritability coupled with high genetic advance over mean which indicated that selection for plant height in early generations would be effective. These results were in agreement with the results of Arunkumar and Veeraragavathatham[2], Bhushana[3] and Upadhyay *et al*[11].

Sufficient amount of variation was seen for the trait number of branches at peak harvest stage with a range of 3 to 16 and mean of 7.20. The estimates of PCV and GCV were found high indicating high range of variability in F_2 population of the cross Utkal Raja x Arka Sourabh. Moderate heritability coupled with high genetic advance as per cent of mean suggested that the selection for number of branches could be effective. Similar results have also been reported by Ghosh *et al*[4]., Mohamed *et al*[8]., and Veershetty[12].

The number of clusters per plant ranged from 5 to 36 with overall mean of 20.50. The estimates of PCV and GCV were high, indicating existence of broad genetic base for this trait in F_2 population of cross Utkal Raja x Arka Sourabh. Higher heritability and high genetic advance as per cent of mean indicates that most likely the heritability is due to additive gene effect. Thus, there is much scope for improving this character by direct selection. The results were in confirmation with earlier reports of Ghosh *et al*[4]., and Bhushana[3].

The number of days to first flowering ranged from 10 days to 31 days with a grand mean of 20.05 days. The PCV and GCV estimates were moderate, which indicate the presence of moderate variability in F_2 population of cross Utkal Raja x Arka Sourabh. High heritability coupled with high genetic advance as per cent mean indicates predominance of additive gene component. Thus, there is much scope for improving this character by simple selection. Similar results have also been reported by Ghosh and Syamal[5] and Ghosh *et al*[4].

Number of fruits per plant ranged from 9 to 78 with a mean of 41.37. High estimates of both PCV and GCV were observed for this trait. A narrow difference between GCV and PCV indicated a lesser influence of environment for this trait. High heritability coupled with high genetic advance as per cent of mean indicated the promising nature of the cross for improvement of this trait through simple selection in further generations. The results were in confirmation with earlier reports of Ghosh and Syamal[5], Mittal *et al*[7]., and Manna and Paul[6].

Average fruit weight ranged from 12.5g to 175g with overall mean of 72.56g. The PCV and GCV estimates were found high which indicates a broad genetic base for this trait. High heritability coupled with high genetic advance over mean indicates the promising nature of the cross in order to increase fruit weight through simple selection in further generations. The results were in confirmation with the findings of Bhushana[3],

Ghosh *et al*[4]., Ghosh and Syamal[5], Mohamed *et al*[8]., and Veershetty[12].

Yield per plant ranged from 0.36 kg to 4.59 kg with a grand mean of 2.88 kg. The estimates of PCV and GCV were high coupled with higher heritability and high genetic advance as per cent of mean in F_2 population of cross Utkal Raja x Arka Sourabh. This indicates that most likely the heritability is due to additive gene effect and selection may be effective for this trait. The results were in confirmation with the findings of Bhushana[3], Ghosh *et al*[4]., Ghosh and Syamal[5] and Mohamed *et al*[8].

The TSS of fruits ranged from 2^o Brix to 5.5^0 Brix with a grand mean of 2.89^o Brix. The PCV and GCV estimates were found moderate which indicates that the variability for TSS found to be medium in the F_2 population of cross Utkal Raja x Arka Sourabh. Moderate heritability coupled with moderate genetic advance as per cent of mean was recorded for TSS. Thus, selection for this trait may result in only minor improvement. Similar results have also been reported by Padmini and Vadivel[9].

The total acidity in F_2 population of cross Utkal Raja x Arka Sourabh found ranging from 0.384 per cent citric acid to 0.768 per cent citric acid with an average mean of 0.566 per cent citric acid. The estimates of PCV and GCV were found to be moderate, which indicates moderate variability. Higher heritability coupled with high genetic advance over mean was recorded for this trait. Therefore, selection for this trait may result in improvement of this trait through simple selection in further generations. The results were in confirmation with the findings of Prathap Reddy and Venkatasubba Reddy[10].

Table 1: Genetic parameters for 9 characters of the segregating population of Utkal Raja x Arka Sourabh

Sl. No.	Character	Mean	Range	PCV (%)	GCV (%)	h^2 (%)	GA	GAM (%)
1	Plant height (cm) at peak harvest stage	57.82	15-110	25.36	21.32	70.64	21.34	36.91
2	Number of branches at peak harvest stage	7.20	3-16	29.30	22.12	57.01	2.47	34.41
3	Number of clusters per plant	20.50	5-36	24.87	22.50	81.85	8.60	41.94
4	Days to first flowering	20.05	10-31	18.01	17.97	99.51	7.40	36.93
5	Number of fruits per plant	41.37	9-78	25.91	25.69	98.34	21.72	52.49
6	Average fruit weight (g)	72.56	12.5-175	35.36	33.43	89.39	47.24	65.11
7	Yield per plant (kg)	2.88	0.36-4.59	30.89	30.18	95.45	1.75	60.75
8	Total Soluble Solids (^{0} Brix)	2.89	2-5.5	20.52	12.82	39.06	0.47	16.51
9	Total acidity (% citric acid)	0.566	0.38-0.76	17.64	17.60	99.59	0.20	36.19

*GCV= Genotypic coefficient of variation, PCV= Phenotypic coefficient of variation, h^2 =Heritability, GAM =Genetic advance as percent mean

CONCLUSION

From the present study it was concluded that there is a wide range of genetic diversity for yield and other economic traits in F_2 population of cross Utkal Raja x Arka Sourabh. Hence, from this population we can

select transgressive segregants with desirable qualities and we can use this population for further crop improvement program.

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