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Short Communication

Assessment of Genetic Variability and Heritability in *Lycopersicon esculentum* Mill.

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ABSTRACT

Various parameters of genetic variability were estimated for number of flowers/plant, number of fruits/plant, number of days for fruit setting and yield/plant in tomato (*L. esculentum*). The variation between the accessions, on the basis of coefficient of variability was greater in traits like number of fruits/plant (13.92%) followed by number of flowers/plant with coefficient of variability (10.75%) and yield/plant (9.99%). Broadsense heritability was highest for number of fruits/plant (96.56%) followed by number of flowers/plant (93.45%) reflecting the effectiveness of selection in the present germplasm of tomato improvement.

Key Words: CV; Broadsense heritability; Yield traits; Tomato

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.) is an important vegetable crop all over the world. In Pakistan, in addition to its other uses, tomato is an essential ingredient of every main course cooked food. Low fruit yield of tomato crop in the country demands the genetic improvement through selection and breeding. Before embarking upon breeding programme aiming at the development of high yielding cultivars, information regarding the extent of genetic variability and degree of heritability of various characters is a prerequisite.

The occurrence of high heritability and genetic advance for number of fruit/plant and average fruit weight in tomato had been earlier found (Mittal *et al*., 1996; Chosh *et al.*, 1996). Some other researcher reported moderate to high genotypic coefficient of variation and phenotypic variability, heritability and genetic advance for number of flowers/cluster, number of fruits per plant and fruit yield; and concluded that yield was positively associated with number of fruits per plants (Srivastava *et al*., 1998). Mohanty (2003) also reflected high genetic variability, coefficient of variation and heritability for number of branches per plant, number of fruits per plant, fruit weight, plant height and number of days to harvest in tomato and further reported that number of fruits per plant and average fruit weight had positive direct effects on tomato yield.

The present studies were, therefore conducted to obtain some information on the extent of variability and heritability for yield related traits in tomato varieties.

MATERIALS AND METHODS

Plant material. The experimental material used in the studies was composed of 10 exotic and local open pollinated varieties of tomato i.e., Riogrande, Nagina, Cchaus, Roma, CLN2318F, CLN2443A, CLN2443B, 2413L, 2418A and 1466EA. The seed of these genotypes was planted in the nursery during November 2002 and transplanted in the field during February 2003 at experimental areas of Vegetable Research Institute, Ayub Agriculture Research Institute, Faisalabad. The nursery of each accession was transplanted in a field in three replications following Randomized Complete Block Design layout. The seedlings were planted in rows having 10-plants per row keeping row-to-row and plant-to-plant distances of 60 cm and 30 cm, respectively. The data were taken for number of flowers per plant, number of fruits per plant, number of days for fruit setting and yield per plant from the middle 5 plants leaving plants on either ends of the row to avoid the border effects. Normal agronomic and plant protection measures were adopted to obtain healthy plants.

Statistical analysis. The data for all traits were analysed following analysis of variance technique (Steel & Torrie, 1980). Coefficient of variability (Steel & Torrie, 1980) and broad sense heritability (Burton & DeVane, 1953) was also estimated to establish the extent of variability and the degree of genetic determination of variation.

RESULTS AND DISCUSSION

Number of flowers per plant. The mean squares for number of flowers per plant for genotype are statistically found highly significant at $P \leq 0.01$ (Table I).

The genotype "Cchaus" had produced the highest number of flowers per plant (172.0) among all other genotypes, whereas least number of flowers per plant (36.5) was produced in the genotypes 1466EA (Table II). The remaining genotypes produced flowers within the range of 50.3 to 160.7.

The value of broadsense heritability (0.9345) showed that about 93% of the variation observed in the character was genetically determined (Table I) and would transfer to next generation (Singh, 2004). The genotype "Cchaus" which produced the highest number of flowers, would give better fruit yield per plant. In a previous study in tomato, Berry and Din (1988), observed that the varieties having more number of flowers gave better production than those having less number of flowers.

Number of fruits per plant. The number of fruits per plant was highly significant ($P \leq 0.01$), which suggested differences between the genotypes for the number of fruits/plant (Table I). The value of heritability, 0.9656, showed that about 96% of estimate of variation was under genetic control and the coefficient of variability was 13.92%, which suggested that 96% of 13.92% variation would transfer to the progeny (Singh, 2004).

The number of fruits per plant ranged from 8.3 to 175.0 (Table II). The genotype that produced the highest number of fruits was "2413 L" among genotypes, a mean value of (175), while the genotype "Roma" produced the lowest number of fruits having average number of fruits (8.3).

The number of fruits per plant has a close bearing with total fruit yield in tomato (Rana & Kalloo, 1989). Therefore, the varieties showing high number of fruits per plant might be high yielding. However, along with number and size, weight of fruit also contributes directly to total yield.

Number of days for fruit setting. Table I showed highly significant differences ($P \leq 0.01$) for number of days for fruit setting. The relatively low value of coefficient of variability was 7.69% and heritability was, 0.3612, which indicated that the character was partially under the control of genes (Singh, 2004).

There was a narrow range among genotypes for number of days for fruit setting ranging from 28.11 to 35.0 days (Table II). Genotype "Cchaus" had the highest mean value (35.00) for this character, while the genotype "1466EA" had the lowest mean value (28.11). The rest of the genotypes had mean values from 29.00 to 34.33 for this character. These results argued that as the genotype "Cchaus" took more days for fruit setting, hence it produce more tomato fruit yield. Parvinder *et al.* (2002) also observed that the variety that had taken more number of days for fruit setting would produce better yield in tomato.

Yield per plant (g). Means squares for genotypes were highly significant at $P \leq 0.01$ for yield per plant. It revealed that the value of heritability was 0.9715, which showed that the observed variation among the genotypes had strong genetic basis (Singh, 2004). The coefficient of variability was 9.99%.

Table II showed the comparison of the varieties for yield. It revealed that genotype "Cchaus" had maximum mean fruit yield (2703 g) produced among all genotypes, while Roma produced the fruit yield (66.6 g) and rest of the genotypes produced yield ranged from 448.3 g to 2295.0 g/plant.

The value of high broadsense heritability (0.9715) that showed about 97% of the variation observed was genetically determined. The results are in agreement with the findings of Mittal *et al.* (1996) and Mohanty (2003).

It may be concluded that the variation between the accessions, on the basis of coefficient of variability was greater in traits like number of fruits per plant (13.92) and number of flowers per plant (10.76). Therefore the present material is rich in variability for these traits (Singh, 2004). The highest value of broadsense heritability (0.9715) for yield per plant showed that about 97% of the variation

Table I. Mean squares and estimates of heritability and coefficient of variability for various characters

Character	Mean squares			$h^2_{(B.S)}$	CV %
	Replication (DF =2)	Genotype (DF =9)	Error (DF =18)		
Number of flowers / plant	189.004	6806.088**	155.388	0.9345	10.75
Number of fruits / plant	50.719	8465.301**	99.208	0.9656	13.92
Number of days for fruit setting	1.207	15.982*	5.927	0.3612	7.69
Yield / plant (g)	62893.272	2048730.633**	19868.053	0.9715	9.99

* = Significant (P<0.05), ** = Highly significant (P<0.01)
h^2 (B.S) = Broad sense heritability
CV= Coefficient of variability

Table II. Comparison of different genotypes for various characters

Genotypes	Number of flowers/plant	Number of fruits/plant	Number of days for fruit setting	Yield/ plant (g)
Cchaus	172.0 a	129.0 b	35.00 a	2703.0 a
2413L	160.7 a	175.0 a	34.33 ab	2295.0 b
Riogrande	138.6 b	85.0 d	33.00 abc	2016.0 c
CLN2318F	170.0 a	105.5 c	30.00 bcd	1537.0 d
Nagina	132.0 b	30.0 f	31.66 a	1506.0 d
CLN2418A	106.3 c	75.0 d	31.00 a d	1693.0 d
CLN2443B	104.1 c	51.7 e	33.66 abc	1005.0 e
CLN2443A	89.0 c	29.0 f	30.66 ad	840.0 e
1466EA	36.5 d	27.5 f	28.11 d	448.3 f
Roma	50.3 d	8.3 g	29.00 cd	66.6 g

Means sharing similar letters in a column are statistically non-significant (P>0.05).

observed for this trait was genetically determined and will transfer to the progeny (Singh, 2004). Similar results have been reported by Srivastava *et al.* (1998), and Mohanty (2003).

So the above findings suggested that for getting higher yield, selection should be practiced for yield related traits giving equal importance to number of flowers per plant, number of fruits per plants and fruit weight.

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