Himachal Journal of Agricultural Research 37 (1):35-38, 2011

Variability studies in tomato (*Solanum lycopersicum* L.) under polyhouse conditions

Mayanglambam Bilashini, Parveen Sharma, N.K. Pathania and Vidyasagar
Department of Vegetable Science and Floriculture
CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur-176 062, India.

Manuscript Received: 05.02.2011; Accepted: 23.06.2011

Abstract

Evaluation of sixteen bacterial wilt resistant hybrids of tomato under modified naturally ventilated polyhouse conditions at the Experimental Farm of the Department of Vegetable Science and Floriculture, CSKHPKVV, Palampur elucidated high magnitude of genotypic and phenotypic coefficients of variation for plant height, , total number of fruits per plant, pericarp thickness and number of marketable fruits per plant. The high estimates of heritability coupled with high GCV and genetic advance were observed for plant height, total number of fruits per plant, pericarp thickness and number of marketable fruits per plant, which indicated the effectiveness of additive gene action.

Key words: Tomato, bacterial wilt, polyhouse and variability.

Introduction

Exploitation of genetic variability in the available germplasm is a prerequisite to any breeding programme. Greater the diversity in the material, more are the chances of getting desired genotypes. Variation for different traits of commercial importance in tomato variety was first reported by Norton (1910). Further partitioning of variability into heritable and non-heritable components will enable to know the effectiveness of selection. Estimation of expected genetic advance is also important to estimate the heritability together with genetic advance in predicting the expected progress to be achieved through selection.

Materials and Methods

The experiment was laid out with 16 diverse tomato hybrids in Randomized Block Design (RBD) at Experimental Farm of the Department of Vegetable Science and Floriculture, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur during the year 2009-2010. Ten plants of each hybrid were transplanted at inter-row spacing of 70 cm and intra-row spacing of 30 cm. The seed was sown in nursery on 21st July 2009 and seedlings were transplanted on 3rd September 2009 inside modified naturally ventilated polyhouse. Standard cultural practices were adopted to raise the crop successfully. Irrigation was applied through drip system twice a week. Five plants of each hybrid were randomly taken from each entry to record the observations on the characters *viz.*, plant height (cm), plant survival (%), days to 50 per cent flowering, days to first harvest, number of marketable fruits per plant, total number of fruits per plant, average fruit weight (g), fruit shape index, gross yield per plant (kg), marketable yield per plant (kg), pericarp thickness (mm), TSS content (%), acidity (%) and ascorbic acid content (mg per 100g). Pericarp thicknesses were recorded with the help of scale. The TSS was determined by hand refractometer at room temperature. Ascorbic acid

was analyzed by 2,6 dichlorophenol indophenol titration method as described in AOAC, and the titrable acidity was determined by adopting the standard methods using phenolphthalein as indicator. Phenotypic, genotypic and environmental variances were computed as per standard methods. The heritability in broad sense and expected genetic advance were determined as per Johnson *et al.* (1955).

Results and Discussion

Analysis of variance for all the traits revealed that genotypes differed significantly among themselves. All the traits showed a considerable range of variation, which was further substantiated by their significant mean squares values. The range of variation and genetic parameters estimated are presented in Table 1. The estimates of PCV and GCV were high for plant height (26.33 and 24.86%), total number of fruits per plant (26.20 and 25.20%), number of marketable fruits per plant (28.29 and 27.38%) and pericarp thickness (25.11 and 24.07%). This suggested that these traits had wide genetic

Table 1. Range, mean, PCV and GCV, heritability (broad sense) and genetic advance for quantitative and quality traits of tomato

Traits	Range	Mean	Coefficient of Variation (%)			Heritability (%) (h^2_{bs})	Genetic advance (% of mea (GA)
			Phenotypic (PCV)	Genotypic (GCV)	Environmental (ECV)		
Plant height (cm)	81.63-213.53	143.55±7.21	26.33	24.86	8.70	89.10	48.33
Plant survival (%)	8.56-10.00	9.78±0.18	4.53	3.23	3.17	50.90	4.74
Days to 50 per cent flowering	25.33-39.00	34.83±1.22	11.11	9.33	6.05	70.40	16.12
Days to first harvest	100.00-145.00	12.71±2.55	11.42	10.90	3.41	91.10	21.43
Number of marketable fruits per plant	12.67-33.87	22.08±0.91	28.29	27.38	7.14	93.60	54.58
Total number of fruits per plant	13.47-33.87	22.75±0.94	26.20	25.20	7.17	92.50	49.94
Average fruit weight (g)	56.05-88.08	68.59±2.30	15.07	13.90	5.80	85.20	26.43
Fruit shape index	0.82-1.17	0.97±0.03	11.77	10.48	5.35	79.30	19.23
Gross yield per plant (kg)	0.91-1.87	1.51±0.09	19.36	16.17	10.65	69.80	27.82
Marketable yield per plant (kg)	0.86-1.87	1.47±0.10	20.98	17.79	11.12	71.90	31.06
Pericarp thickness (mm)	2.36-6.76	4.82±0.20	25.11	24.07	7.17	91.90	47.52
TSS content (%)	3.23-5.93	4.77±0.23	16.69	14.56	8.16	76.10	26.16
Acidity (%)	0.50-0.87	0.70±0.03	15.80	13.79	7.72	76.10	24.79
Ascorbic acid (mg/100g)	19.50-28.50	23.75±0.89	11.78	9.81	6.51	69.40	16.85

variability and should response better to selection. The PCV was higher than the respective GCV for all the traits denoting environmental factors influencing their expression to some degree or other. These results are in conformity to those of earlier researchers for fruits per plant (Bora *et al.*, 1993; Bharti *et al.*, 2002; Ara *et al.*, 2009; Shashikanth *et al.*, 2010; Rukhsar *et al.*, 2011; Iraj *et al.*, 2011), plant height (Sahu and Mishra, 1995; Mohanty, 2003; Golani *et al.*, 2007) and pericarp thickness (Pujari *et al.*, 1995; Pradeepkumar *et al.*, 2001).

The heritability in broad sense ranged from 50.90 to 93.60 per cent. High heritability in broad sense indicated that large portion of phenotypic variance was attributable to the genotypic variance and the traits with high heritability estimates were less influenced by the environment. The genetic advance as per cent of mean varied from 4.74 to 54.58 per cent. Higher genetic advance was obtained for number of marketable fruits per plant (54.58%), total number of fruits per plant (49.94%), plant height (48.33%) and pericarp thickness (47.52%) which portrayed that they could be improved to a large extent through selection. High heritability for fruits per plant (Sahu and Mishra, 1995; Pradeepkumar *et al.*, 2001; Shashikanth *et al.*, 2010), days to first harvest (Bora *et al.*, 1993) and pericarp thickness (Mohanty, 2002) had also been reported.

High heritability along with high genetic advance was observed for the traits plant height, total number of fruits per plant, pericarp thickness and number of marketable fruits per plant, which might be assigned to additive gene effect governing their inheritance and phenotypic selection for this improvement could be achieved by simple method like pureline, mass selection, bulk, or SSD method following hybridization and selection in early generations. Similar research findings have also been reported by Mittal *et al.* (1996), Bharti *et al.* (2002) and Shashikanth *et al.* (2010).

High heritability coupled with moderate GCV and genetic advance was observed for days to first harvest and average fruit weight, which might be attributed to non-additive gene action controlling their expression, and simple selection would not be rewarding.

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