SUMMARY

The present investigation aiming at genetic upgrading of yield attributing characters, fruit quality and earliness with resistance to cracking and rotting of fruit was conducted at Jawaharlal Nehru Krishi Vishwa Vidyalaya, College of Agriculture, Indore during 1983-84 and 1984-85. This study embodied the identification of suitable crosses which could give promising hybrids and segregants. Estimates of gene effects involved in the inheritance of important characters under study would be useful in adequate breeding programme.

Six promising, but divergent genotypes of tomatoes (*Lycopersicon esculentum* Mill) were selected based on some of the desirable qualities and five crosses were attempted viz. (i) ACC 99 x Pusa Ruby (ii) ACC 99 x Sweet 72, (iii) Pusa Ruby x ACC 5 (iv) ACC 72 x ACC 99 (v) ACC 72 x Marglobe. The $F_1$, $F_2$ and $F_3$ progenies were developed and were grown alongwith parents at a distance of 60 cm x 60 cm (as per recommended package of practices) in a randomised block design with three replications. The data were obtained for days to first flowering, days to 50% flowering and maturity, plant height, number of
branches per plant, stem girth, weight per fruit, fruit size (length x width), fruit yield per plant, number of locules per fruit, weight of cracked/rotted fruits per plant, reducing sugar and vitamin C content. The data were analysed for analysis of variance to determine the significance of variations in parents and their progenies. The midparental values, heterosis over mid and better parental values and inbreeding depression were computed using the standard statistical techniques. The estimates of various gene effects and the epistatic interaction on inheritance of characters in progenies were worked out based on the generation means as per method suggested by Hayman (1958) and Singh and Chaudhary (1979). The generation means of $F_1$, $F_2$, $F_1$, $F_2$ and $F_3$ were used to estimate 5 of the 6 genetic parameters viz. $b$, $d'$, $h$, $l$ and $l$ representing the $F_2$ mean, additive, dominance and interactions of additive x additive and dominance x dominance, genic inheritance to isolate the genotypes having early, high yielding and comparatively resistant to cracking/rotting of fruits with good quality. The results are summarised as under:

**Generation means, Heterosis and Inbreeding depression:**

The analysis of variance for phenological characters showed significant differences in the progenents and their
progenies in all the characters in all the crosses with exception of days to first flowering and 50% maturity in ACC 72 x Marglobe and 50% flowering in ACC 72 x ACC 99 during first year only. In the crosses namely ACC 99 x Pusa Ruby, ACC 72 x ACC 99 and ACC 72 x Marglobe, the plants in F₁ flowered and matured earlier even than the better parents, which indicated the overdominance of earliness over lateness.

As regards growth characters, significant differences amongst parents and their generations were observed in all the crosses except in ACC 99 x Sweet 72 for plant height and ACC 72 x ACC 99 for number of branches during second year. The F₁ values were found to be tending towards midparental values in most of the crosses, while number of branches were found to be increased in F₁ as compared to better parent in crosses ACC 99 x Pusa Ruby, ACC 99 x Sweet 72 and Pusa Ruby x ACC 5. However, the differences were significant only in cross Pusa Ruby x ACC 5. For stem girth, the significant differences were noticed in all the crosses and the values of F₁ were mostly at par to midparental values.

In case of yield attributing characters, the significant differences were noted in all the crosses excepting
in ACC 72 x ACC 99 for fruit length and ACC 72 x Marglobe for fruit width during first year only. The weight per fruit and fruit size was recorded maximum in F₁ in crosses ACC 99 x Pusa Ruby, ACC 72 x ACC 99 and ACC 72 x Marglobe. In cross ACC 72 x Marglobe, locule number per fruit were found to be significantly increased in F₁ as compared to better parent.

The differences in yield per plant were significant in all the crosses except in cross ACC 99 x Pusa Ruby during the first year. Yield per plant was recorded maximum in F₁ in all the crosses and this increase in yield was significant over low yielding parents.

The reduction in cracking/rotting of fruits was also observed in F₁ and the differences were significant in all the crosses excepting ACC 72 x Marglobe during second year. The estimates of heterosis were high in all the crosses except in ACC 72 x Marglobe and the reduction in cracking was noted 52.0 to 66.0 percent over better parent and 40 to 53 percent over midparent.

The differences amongst parents and their progenies were significant in crosses namely ACC 99 x Sweet 72, Pusa Ruby x ACC 5 and ACC 72 x ACC 99 for vitamin C content and Pusa Ruby x ACC 5, ACC 72 x ACC 99 and ACC 72 x Marglobe for sugar content.
Estimates of Genetic Components:

The inheritance for earliness (days to 50% flowering) was found to be controlled predominantly by dominant gene effect although the additivity was also significant. The epistatic effect of additive x additive nature was found in ACC 99 x Sweet 72 and Pusa Ruby x ACC 5, while dominance x dominance type of gene interaction was detected in ACC 99 x Pusa Ruby. The earliness was dominant over lateness. The nature of epistasis was complementary in all the crosses excepting Pusa Ruby x ACC 5. The estimates for 50% maturity were also significant for additive and dominance gene effects in most of the crosses but most of the estimates were negative and varied between years. The additive x additive gene interaction was significant in ACC 99 x Pusa Ruby only during first year and ACC 99 x Sweet 72 and Pusa Ruby x ACC 5 during both the years. In the remaining crosses and also in ACC 99 x Pusa Ruby, dominance x dominance type of epistasis was noted during second year only. The nature of epistasis was mostly complementary.

The estimate of genetic factors revealed significant contribution of additive and dominant gene effects on plant height. The interaction of additive x additive was found
in all the crosses except ACC 99 x Sweet 72. The dominance 
ox dominance type of epistasis was detected in ACC 99 x Pusa 
Ruby. The epistatic effect was mostly duplicate. The 
estimates of heterosis were positively high in ACC 99 x 
Pusa Ruby and ACC 99 x Sweet 72 and negative in remaining 
crosses.

As regards the branches per plant, the additive 
gene effect was significant in all the crosses but the 
dominance gene effect was significant in ACC 99 x Pusa Ruby, 
ACC 99 x Sweet 72 and Pusa Ruby x ACC 5. The epistatic 
effect of additive x additive and dominance x dominance was 
found mostly in all the crosses excepting ACC 99 x Pusa Ruby 
during first year and ACC 72 x ACC 99 during second year. 
The estimates of heterosis were low in almost all the 
crosses.

The weight per fruit was inherited mainly by additive 
gene effect in all the crosses and dominant gene effect in 
four corses excepting ACC 99 x Sweet 72. The significant 
but negative additive x additive gene effect was detected 
in ACC 99 x Pusa Ruby, Pusa Ruby x ACC 5 and ACC 72 x 
ACC 99, while positive and significant in case of ACC 99 x 
Sweet 72. The higher magnitude of dominance x dominance 
type of gene interaction was noted in ACC 99 x Pusa Ruby
and Pusa Ruby x ACC 5. The nature of epistasis was mostly duplicate but complementary type of epistasis was also detected in ACC 72 x Marglobe during both the years. The estimates of heterosis were also high.

The estimate for fruit size were significant for additive gene effect in most of the crosses, while significant effect of dominant gene was noted in crosses namely ACC 99 x Pusa Ruby and ACC 72 x ACC 99 during both the years. The dominance x dominance gene effect was positively significant in almost all the crosses but the greater contribution of this component was noticed in ACC 99 x Pusa Ruby. The nature of epistasis was complementary in cross ACC 72 x Marglobe.

The estimate of additive (a') gene effect were significant in all the crosses for locule number but the dominance gene effect was noted in ACC 99 x Pusa Ruby only. The significant and positive effect of dominance x dominance gene interaction was observed in cross ACC 99 x Pusa Ruby during both the years. The nature of epistasis was complementary in ACC 72 x ACC 99 and ACC 72 x Marglobe, while duplicate in the remaining crosses.

The additive and dominant gene effect for fruit yield per plant were significant except in ACC 99 x Pusa
Ruby. The additive x additive type of epistasis was significant in ACC 99 x Sweet 72, Pusa Ruby x ACC 5 and ACC 72 x Marglobe, whereas dominance x dominance type of epistasis was inferred in Pusa Ruby x ACC 5 and ACC 99 x Pusa Ruby. The estimates for heterosis were high in all the crosses.

The additive effect on cracking/rotting of fruits was exhibited in all the crosses except in ACC 72 x Marglobe and in some crosses dominant gene action was also found. Additive x additive type of gene interaction was also significant except in ACC 72 x Marglobe. In three crosses namely ACC 99 x Pusa Ruby, ACC 99 x Sweet 72 and ACC 72 x ACC 99, dominance x dominance type of epistasis was noted. The nature of epistasis was mostly duplicate. The cracking/rotting was more in ACC 99 and ACC 5 and significantly less in Sweet 72 and Pusa Ruby. The hybrids produced less cracked/rotted fruits and the resistance to cracking/rotting was found dominant over less resistance. High vitamin C content was found to be associated with resistance to cracking/rotting.

The additivity and dominance gene effects were noted for vitamin C content and soluble sugars in most of the crosses. The epistatic interactions 1 and 1 were also detected for these traits.
From the present study, the following conclusions could be drawn:

1. By inducing earliness, the early maturing varieties may be developed for commercial uses. In the present studies, the crosses ACC 99 x Pusa Ruby, ACC 99 x Sweet 72 and Pusa Ruby x ACC 5 indicated such response which may be exploited.

2. Crosses ACC 99 x Pusa Ruby and ACC 99 x Sweet 72 gave rise to the progenies which had moderate plant height, medium fruit size and resistance to cracking/rotting with high yield potentialities. These generations will be further developed for commercial use.

3. The vitamin C content was higher in progenies where Pusa Ruby or Sweet 72 was used as parent. Vitamin C content was also found to be associated with resistance to cracking/rotting of fruits. This will also be exploited in selection of better plant type in due course of time.