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Genetic analysis for fruit yield and its component characters in tomato (*Lycopersicon esculentum* Mill.)

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SUMMARY

A field trial was conducted to ascertain the genetics of fruit yield and its components using six generations of five crosses in tomato. The analysis exhibited the presence of additive, dominance and epistatic interactions in almost all the cases indicating the importance of both additive and non-additive gene actions for the expression of these traits. Duplicate type of gene action was also observed in majority of the cases. In this situation, recurrent selection, bi-parental mating, inter se mating between desirable segregants followed by selection can be employed in such genotypes.

Key words : Additive and non-additive gene action, generation mean analysis, *Lycopersicon esculentum* Mill.

The knowledge of gene effects for different traits in tomato is of prime importance before starting a breeding programme. Determination of the most suitable breeding method and selection strengthening for improvement of a trait would depend on the knowledge of gene actions operating in the breeding population. Generation mean analysis has a general application for genetic evaluation of any population irrespective of gene frequency and mating design. This provides not only valid estimate of gene effects but also an unambiguous test for presence or absence of epistasis. The present investigation was, therefore, undertaken to study the inheritance of fruit yield and its related characters in tomato and to suggest appropriate breeding approaches for its improvement programme.

MATERIALS AND METHODS

The experimental material comprised of five crosses *viz*., Feb 4 x KS 17, GT 2 x KS 17, Sel 14 x KS 118, GT 2 x GT 1 and SL 120 x Angur Lata. The six generations *viz*., P_1, P_2, F_1, F_2, B_1 and B_2 of each of five crosses were grown in compact family block design with three replications during 2005-06 at Main Vegetable Research Station, Anand Agricultural University, Anand (Gujarat). Each plot had one row for parents and F_1, two rows for each of the B_1 and B_2 and four rows for F_2 population. Each row consisted of 10 plants and the inter and intra row spacing was 90 and 75 cm, respectively.

Data were recorded on days to flower initiation, plant height (cm), fruit length (cm), fruit girth (cm), fruit weight (g), fruits per plant and fruit yield per plant (kg / plant). The characters were measured / recorded for five, ten and twenty competitive and randomly taken plants from each plot of homogeneous materials (parents and F_1s), backcrosses (B_1 and B_2) and F_2 generation, respectively.

The scaling tests A, B, C and D of Haymen and Mather (1955) were performed for all the characters under study to judge the adequacy of the additive - dominance model. Further it was confirmed by the joint scaling test given by Cavalli (1952). The crosses where the additive - dominance model was inadequate the genetic analysis carried out following Hayman (1958) using six-parameter model given by Jinks and Jones (1958).

RESULTS AND DISCUSSION

The A, B, C and D scaling test carried out in the five crosses indicated the presence of non-allelic interactions in almost all the cases except for days to flower initiation in the cross GT 2 x GT 1, for fruit length and fruit girth in the cross Feb 4 x KS 17, and in the cross SL 120 x Angur Lata for the traits *viz*., days flower initiation, fruit length and fruit girth (Table 1). In all other cases, the additive - dominance model was found to be inadequate to explain the gene action. The A and B scaling tests provided the evidence for the presence of ‘i’ (additive x additive), ‘j’ (additive x dominance) and ‘l’ (dominance x dominance)

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gene interactions. The 'C' scaling test gave the information about 'i' type of gene interaction. The presence of epistatic interaction for most of the characters was also evident from the results of analysis of digenic epistatic model for the five crosses

In case of days to flower initiation, only additive type of gene effect and additive and dominance type of gene effects were found to be important in the cross SL 120 x Angur Lata and GT 2 x GT 1, respectively indicating that yield in this case could be improved by simple selection procedure. All the genetic components except additive x dominance (j) gene interaction were also important in the crosses Feb 4 x KS 17 and GT 2 x KS 17. The additive x dominance (j) and dominance x dominance (l) gene interactions were important for Sel 14 x KS 118. Importance of both additive and non-additive gene actions for days to flower initiation was reported earlier (Kanthaswamy *et al.*, 1995 and Devi *et al.*, 2005). The epistasis for days to flower initiation was found to be duplicate type in the crosses Feb 4 x KS 17 and GT 2 x KS 17 confirming the complex nature of inheritance of yield.

For plant height, all type of gene effect was found to be significant in all the five crosses except for 'j' in crosses Sel 14 x KS 118 and GT 2 x GT 1, and 'l' in the cross GT 2x GT 1, and dominance type of gene effect in cross SL 120 x Angur Lata. The epistasis was of duplicate type in the crosses Feb 4 x KS 17, GT 2 x KS 17 and Sel 14 x KS 118. Importance of epistatic interaction in control of this trait was reported by Kanthaswamy *et al.* (1995).

For fruit length and fruit girth, only dominance gene effect was found significant in the cross Feb 4 x KS 17 whereas, both additive and dominance gene effects were found to be significant in cross SL 120 x Angur Lata. Duplicate type of epistasis was observed for both the traits in the cross GT 2 x KS 17. Additive gene effect as well as dominance x dominance type of epistasis was observed for both the traits in the crosses Sel 14 x KS 118 and GT 2 x GT 1. Importance of both additive and non-additive gene effects for fruit length and fruit girth were reported earlier by Sharma *et al.* (1999).

In case of fruit weight, all the type of gene effects were found significant in all the crosses except dominance x dominance type of gene effect in the cross GT 2 x KS 17. The epistasis for fruit weight was found to be duplicate type in the crosses Sel 14 x KS 118, GT 2x GT 1 and SL 120 x Angur Lata. Importance of both additive and non-additive gene effects for this trait was reported earlier by Sharma *et al.* (1999) and Devi *et al.* (2005).

For fruits per plant and fruit yield per plant, all the type of gene effects were found to be significant except for additive type of gene effect in the cross SL 120 x Angur Lata and dominance and additive x additive type of gene effects in the crosses GT 2 x GT 1 and SL 120 x Angur Lata for fruits per plant and fruit yield per plant, respectively. Duplicate type of epistasis was observed in all the crosses except GT 2 x GT 1 for fruits per plant and SL 120 x Angur Lata for fruit yield per plant which confirming the complex nature of inheritance of yield. Importance of additive, dominance and epistasis type of gene effects were reported earlier by Kanthaswamy *et al.* (1995) and Devi *et al.* (2005).

The estimates of different type of gene effects provided a test for gene action and were useful for analysing genetic architecture of a crop so as to further improve it for desired traits. The estimates obtained from each cross may be unique in varying degrees and may not be applicable to the parental population. Dominance genetic variance formed the major part of the genetic variance for the important yield components.

The use of intermating of selects followed by visual selection in early segregating generations which would simultaneously exploit the gene effects has been suggested. Further, this approach is likely to break some undesirable linkages resulting in the establishment of rare and useful recombinant.

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