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Multivariate analysis and choice of parent for hybridization in apple (*Malus* x *domestica* Borkh.)

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Medium quantum of genetic divergence was observed among sixteen apple genotypes under the present study. All the genotypes, on the basis of total variability were grouped into four distinct clusters. Maximum number of cultivars were accommodated in cluster IV (Fuji, Gala, Jonadel, Jonagold, Red Fuji, Royal Gala and Spijon) followed by cluster I (Arlet, Ruspippin, Sinta and Summerred), Cluster III (Crimson Gold, Elstar and Neomi) and cluster II ('Spartan' and 'Quinte'). Cluster IV had highest intra cluster value (9.32) so was most divergent and cluster I having least intra cluster value (8.20) was least divergent. Highest value (30.331) for inter cluster distance was recorded between cluster I and II while it was lowest (9.994) between cluster III and IV. Cluster means were maximum in cluster II followed by cluster I, cluster III and cluster IV. Neomi was best cultivars for fruit yield/plant, fruit length, fruit diameter, fruit weight, total sugars and non-reducing sugars, however, Jonagold was best for TSS. Cultivars Spartan, Elstar, Royal Gala, Jonagold and Summerred would prove best for different vegetative characters.

Key words : Apple, Cluster analysis, D^2 statistics, Genetic divergence

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INTRODUCTION

The cultivated apple (*Malus* x *domestica* Borkh.) is a member of family Rosaceae and sub family Pomoideae, have originated in south western Asia, Asia Minor, the Caucasus central Asia and the Himalayan region of India and Pakistan (Juniper *et al.,* 1999). It is an important temperate fruit crop of India with respect to acreage, production, economic value and above all popularity among the consumers. In India, it is a prime commercial fruit crop of Himachal Pradesh, Jammu and Kashmir and Uttranchal and some parts of north eastern states including Arunachal Pradesh, Sikkim, Nagaland, Meghalaya and Nilgiri hills of Tamil Nadu (Awasthi and Chauhan, 2001). Apple productivity has gradually declined since 1975 till date and on the basis of low production and productivity, India is now ranked 10th in the world apple cultivation scenario. The important factors which are responsible for low productivity are age old varieties, inappropriate sites, irregular bearing, poor soil conditions, lack of suitable adaptable cultivars and poor selection of pollinizers and their inadequate proportion. Therefore, urgent need is felt for development/introduction of new improved varieties which could help in elevating the apple productivity in India. For the success of any breeding programme the basic requirement is the variability found within the members of the population. It is this variation which if heritable could be used for cultivar improvement, as improved cultivars are the backbone of any orchard system. Therefore, prior to initiation of any breeding programme they should be tested and extent of variability present must be adequately assessed so that the breeding programme could yield the desired results. To use or exploit the available variability present in the genetic material in the form of some specific groups or classes, the divergence studies based upon some desirable/suitable parameters is of very essential and of utmost significance. Keeping in view, the above the genetic divergence and cluster analysis using D^2 statistics was undertaken with the objectives to assess the variability present among the sixteen apple genotypes and potential use of this variability for hybridization programmes. Use of Mahalanobis D^2 statistics to estimate or evaluate the net/total divergence in