INTRODUCTION

Pearl millet (*Pennisetum typhoides* (Burm.) Stapf and Hubb.) is a short duration high yielding food and feed crop of the subtropics and tropics. More than fifty percent of the world acreage under pearl millet falls in India (12.5 million hectares*). On the basis of acreage, it ranks as the fourth important food grain crop after rice, wheat and jowar in this country.

Unlike sorghum, pearl millet is free from cyanide at all stages of its growth, hence forms a better quality forage. Its grain supplies 80 to 90 percent of the calories for millions of poorer people in the world. If pulse is the 'poor man's meat', millet is the 'poor man's bread'. Chemical analysis of a number of important food grains have revealed that fat content of pearl millet is the highest of all the cereals, ranging between 4.8 and 6.2 percent and also higher in minerals (particularly in calcium and iron) and similar in other principal constituents (Aykroyd, Gopalan and Balasubramanian, 1963). Its protein content varies from 8.8 to 20.9 percent on dry weight basis and is very rich in several of the essential amino acids except lysine (Burton, Wallace and Rachie, 1972). Preliminary works suggest that protein and lysine contents of pearl millet can be improved further by genetic manipulations.

In spite of the high potential of total and per day productivity of pearl millet in India, it is primarily grown

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in relatively less fertile lands and under rainfed conditions and consequently the low yields. The traditional open-pollinated varieties would yield on an average 350 to 400 kg grain/ha. However, with the advent of hybrid varieties and with somewhat improved husbandry the average yields increased many-folds and the crop became more popular, particularly in the dryland areas (about 70% of the cultivated area in the country is unirrigated).

Considering high adaptibility, excellent nutritive value and high yielding ability of pearl millet, it is desirable to exploit the potentialities of this crop and to evolve efficient genotypes. Until recently this crop had not received due attention of the crop geneticists. It was only after the identification of an elite male-sterile line, 'Tift. 23A', by Burton (1958) in Georgia and further its introduction in this country that the high yielding hybrid varieties were developed and released for cultivation. Though the productivity of the hybrid varieties is high, they are relatively more susceptible to diseases, like downy mildew, ergot, rust and smut and thus their adoption has not been as wide as expected.

* One of the main reasons of instability in yield and susceptibility of the prevalent hybrids is the genetic narrowness of the female lines and to a certain extent of the fertility restorer lines involved in production of the hybrids. Attempt must be made to broaden the genetic base of the lines to be ordered in hybrid varieties production. Considering the high genetic diversity of the genetic collections of pearl millet
The diallel cross analysis may be performed on F₁ and F₂ generations and it provides estimates of variance and co-variance of the parents in their respective sets of crosses. The different diallel analyses (component, graphic and combining ability) give complete information on the degree of dominance and overdominance of genes governing the character, the distribution of dominant and recessive alleles among the parental lines, the nature and magnitude of gene action, the balance of negative and positive genes, the ratio of dominant and recessive genes, the combining ability of the parents, the heritability of the traits, the detection of gene interaction and an estimate of the number of genes controlling individual character. Validity of all these estimates, however, is based on certain assumptions which must be fulfilled as closely as possible, otherwise the analysis is invalidated to some extent. However, if the analysis is made on F₂ generation, the bias in the estimates of genetic parameters occurring due to linkage effects, epistasis and correlated gene distribution may partly be overcomed.

In breeding programmes, it is often necessary to evaluate different aspects of breeding behaviour of a large number of parents. Complete diallel cross, involving all possible crosses between a set of parents, may be impractical in such cases. For this reason, the concept of partial diallel cross which involves only a sample of all possible crosses of complete diallel was introduced (Kempthorne, 1957; Gilbert, 1958; Hinkelmann and Stern, 1960; Kempthorne and Curnow, 1961; Fyfe and Gilbert, 1963; Federer, 1967). This design allows a large number of inbred lines, where, S is the number of crosses in which a single line
is involved. The total number of crosses depends on the size of S. Studies with varying S sizes would help in determining the extent to which the diallel crosses in pearl millet could be fractioned keeping in view the economic and statistical considerations.

With the above considerations, the present experiments involving 17 diverse inbreds, their non-reciprocal full diallel F_1's and F_2's and fractional F_1 diallels were studied with the following objectives:

1. To estimate the nature and the magnitude of genetic variances for a set of agronomic and yield characters.

2. To estimate the combining ability variances and the combining ability effects of the different parents and crosses.

3. To compare the estimates of the general combining ability variances and effects in the different partial diallel sets with those of the full diallel in F_1 generation and to find out the appropriate size of the partial diallels which may permit estimation of the general combining ability (GCA) variances and effects of large number of parents without loss of precision.

4. To measure the degree of heterosis as to explore the possibility of isolating some superior lines and their specific combinations which may be ordered in heterotic breeding.

5. To formulate an effective breeding programme based on the above estimates which may exploit different gene actions in most efficient fashion.