CHAPTER I
INTRODUCTION

Pulses are the mainstay of Indian agriculture which have enabled the land to turn out reasonable amount of food and fodder over the past several centuries, without adding any manure or fertilizers. They are highly valued for their unique quality of fixing nitrogen as an available nutrient from inexhaustible supplies of inert nitrogen in the atmosphere with the help of symbiotic bacteria present in their root nodules. Besides yielding grain, vegetables, green fodder, silage and hay consumed by us and our cattle, they replenish our impoverished soils and have not only accounted for increased yield of the cereals with which they are rotated, but have also kept our soils alive and productive.

Pulses form an important part of Indian dietary. Both the green pods and grains are rich in protein and are excellent source of vitamins and minerals. They are the cheapest and the best source of vegetable proteins which serve as a necessary adjunct to predominantly starchy diets of millions of vegetarian populace of our country. Protein content in pulses varies from 17 to 25 per cent (Swaminathan et al., 1970). Amino-acid composition of pulse protein is such that a mixed diet of cereals and pulses has a far higher biological value than either of the components.

Among the pulses grown in India, peas are extensively grown accounting for 5.2 per cent of the total pulse production in the country. It occupies an area of 820.6 thousand hectares in the
country, but the most unhappy situation is that this area produces only 496.7 thousand tonnes of grains, resultantly average yield is miserably low (600 kg/ha).

The present poor yield of this pulse can possibly be attributed to the lack of high yielding and fertilizer responsive varieties of broad genetic base. Non-availability of early maturing and high yielding types made this crop less attractive to the farmers. Further, undue emphasis laid by government for achieving self-sufficiency in cereals owing to their comparatively better yields, made them more lucrative and pulses as a whole remained to be the most neglected group of crops. Therefore, there is an imperative need to breed varieties which as a result of their improved plant type with more favourable response to agro-techniques are likely to yield a greater quantity of grains. Equally important, perhaps, is the need to develop relatively photo-insensitive varieties which may enable to cultivate this pulse in the non-traditional season and areas.

Presently, a variety T 163, evolved as early as 1950, is under cultivation throughout the country. All attempts to breed still better variety have failed so far. It is mainly because of low genetic diversity in the genetic stock available in the country and also because of the poor knowledge of genetic architecture of the yield and its components.

The quantitative genetic approach permitting accurate estimation of population parameters has been quite successful in raising yield levels in cereals and cross-pollinated crops, but
it has received very little attention of breeders and geneticists working with this pulse.

For making hybridization programme successful, selection of right type of parents is most important step. The selection on the basis of phenotypic performance for few characters is quite misleading as the parents appearing quite attractive and promising often give poor segregates. It is, therefore, essential that the parents may be selected on the basis of their genetic make up. Several techniques have been in vogue for screening the available varieties/cultivars with a view to selecting the types suited for a particular breeding programme. Diallel and partial diallel cross techniques have extensively been used in many food, commercial and vegetable crops. These techniques have the limitation for including large number of varieties/cultivars. Line x tester analysis is the remedy for this limitation to a great extent. Besides it, this technique provides information on combining ability variances, combining ability effects, heritability and genetic advance which are most important parameters for any breeding programme. Further, the assessment of genetic divergence among populations through multivariate analysis is useful for classificatory problems as well as for choice of parents for breeding work in different breeding systems. $D^2$ statistic technique of multivariate analysis of divergence can detect the divergence even in small group of varieties. This technique has been employed successfully in crops like pearl millet, cow-pea, tomato, rice, linseed, wheat, cotton, sorghum, green gram, chillies etc., by several workers and is being used in this crop probably for the first time.
Therefore, with the view of importance of this pulse in Indian agriculture and line x tester analysis as an efficient biometrical tool the present investigation "Genetic divergence and combining ability studies in genus Pisum L." was undertaken.

The major objectives of the present investigation are as follows:

1. To estimate general and specific combining ability variances.
2. To estimate general and specific combining ability effects.
3. To estimate heterosis manifested in $F_1$ and inbreeding depression incurred in $F_2$.
4. To estimate heritability and genetic advance through parents, $F_1$s and $F_2$s.
5. To establish phenotypic, genotypic and environmental associations, if any, among the characters under study.
6. To study the genetic divergence among the parents in respect of the characters under study.