CHAPTER I
INTRODUCTION

In India, vegetables occupy an important place in diversification of agriculture and play a vital role in food and nutritional security of ever growing population of our country. India is the second largest producer of vegetables in the world. In India, total area under cucurbits cultivation was 15.1 lakh hectares with production of 22.20 million metric tonnes and productivity of 14.70 tonnes per hectare which also include ridge gourd. In Gujarat, total area under cucurbits during 2015-16 was 1.9 lakh hectares with production of 2.69 million metric tonnes and productivity of 14.17 tonnes per hectare which include ridge gourd. (Anon., 2016).

Ridge gourd (Luffa acutangula (Roxb.) L.) belongs to the family Cucurbitaceae which includes about 118 genera and 825 species. Ridge gourd or angled gourd is cultivated in all tropical regions of the world. In India, it is grown as summer and kharif season crop. The somatic chromosome number of ridge gourd is 2n=2x=26. It is a monoecious and cross pollinated annual crop characterized by long vines having branched tendrils. The leaves are glabrous, five to seven lobed while the flowers are yellow coloured, having corolla of five petals. The staminate flowers grow in raceme while pistillate flowers are solitary. The anthers are free and five in number, pistil has three bilobed stigma and ovary with three placentae and many ovules. The fruit is large oblong pepo and ribbed. The dry fruit consists of a hard shell surrounding a stiff, dense network of cellulose fibers. The seeds are generally black and may have either smooth or pitted surface.

The immature tender fruits are used as a cooked vegetable. These soft fruits are easily digestible and appetizing and therefore prescribed for malaria and other seasonal fevers. Nutritively, ridge gourd contains 95.4% water, 3.7% carbohydrates, 0.5% protein, 0.1% minerals, 0.4% calcium, traces of iron, vitamin B and vitamin C. It also contains a gelatinous compound called luffein. The genus derives its name from loofah, fibre of mature dry fruit which is used as bathing sponge, scrubber pad, doormat, in mattresses and also as an insulator.
In the genus *Luffa* varying numbers of species have been identified by different workers. Thakur and Choudhury (1967) described eight species, Seshadri (1986) described five species. However, Chadha and Lal (1993) described six species of *Luffa*, where *L. tuberosa* and *L. umbellata* have been considered synonyms of species *momordica* and *cucurbita*, respectively. Thus, only four species have been undisputedly established as species occurring mostly in tropical region of the old world. These are *L. cylindrical*, *L. acutangula*, *L. echinata* and *L. graveolens* and all these species are grown in India. Of these cultivated species, *L. cylindrica* and *L. acutangula* are economically important because of their unripe fruits most commonly used as vegetables.

Species of *Luffa* are domesticated and indigenous in tropical Asia. Asiatic region especially India and Malaya may be the origin of *Luffa* (Markelots, 1972).

South and South East Asia are the centers of diversity of *Luffa*. A large number of diverse germplasm lines are available in these areas. This includes small fruited cluster type, long fruited type and dwarf to long vine type, but there is no systematic germplasm collection, evaluation and conservation programme at international level. Consequently, there is no systematic approach to *Luffa* improvement. However, the attempts have been made to collect and improve the local cultivars grown in different parts of India, resulted in development of improved varieties like Pusa Nasdar, Co-1, Punjab Sadabahar, Satputia etc. (Seshadri, 1986; Chadha and Lal, 1993).

Although, ridge gourd is grown extensively, the research efforts for its improvement are lacking. Distinct variability in fruit characters like size, shape, fruit surface, colour, number of seeds per fruit, maturity, fruit yield per plant, monoecious nature and large bud size impart great opportunity for developing hybrids/varieties having high fruit yield with desirable morphological and quality characters.

For any successful breeding programme genetic information on variability, combining ability, gene action, extent of heterosis and association between different characters is of paramount importance. This information helps in identifying the best genotype, best cross combination and also breeding
methods to be followed either for exploiting hybrid vigour or different selection procedures through pedigree breeding and also to construct plant architecture through different selection indices.

Ridge gourd is grown extensively and exhibits a wide range of variability in fruit and vegetable characters. It is a cross pollinated crop and thus exhibits considerable heterozygosity in population and does not suffer from inbreeding depression. The natural variability in ridge gourd provides ample scope for exploitation of hybrid vigour. However, the same has not been assessed and utilized. The hybrid vigour remains unexploited and nationwide released hybrids from public sector or institutions are not available. Even now, local strains of ridge gourd are commercially grown by farmers which result into very low yield. Poor performance of local varieties is due to genetic impurities. The prime limitation in the practical utility of hybrid vigour, however, it is maximum in F₁ generation only. Therefore, the greater emphasis is necessary on production of fresh hybrid seeds every year on commercial scale. Exploitation of hybrid vigour has been important parameter in the kit of tools with the plant breeders.

One of the easiest method to assess heterosis is based on *per se* performance of crosses which depends on genetic variation as well as genetic divergence among the parents. Critical choice of parents is important, particularly for improvement of complex polygenic characters like yield and its component traits, because a high yielding genotype may not necessarily transmit its superiority in cross combinations. Therefore, a breeder often deals with the problem of selecting desirable parents for breeding better varieties/hybrids. However, nature and magnitude of heterosis is one of the important aspects for selection of the right parents for crosses and studying gene effect and also help in identification of superior cross combination that may produce desirable transgressive segregants in advanced generations.

Accordingly, breeder should have genetic information with respect to genetic basis of yield and its components, nature of gene action and combining ability of the elite parents. Selection of parents are the most important aspect of any hybridization programme and plant breeders should be sure that the selected genotypes could be explorable and must be in balance with the environment in which they are to be grown. All the selected
parents may not result in production of desirable hybrids because of the ability to combine well with some, while poor with others. These aspects force the plant breeders to realize the importance of studying the general and specific combining abilities of the parents and hybrids, respectively.

Exploitation of hybrid vigour has been recognized as an important tool for making genetic improvement of yield and its attributing characters in ridge gourd by earlier workers. Therefore, preliminary evaluation of the genetic stock available for use in hybridization programme is important to identify heterotic hybrids and to select elite parents. These may then be utilized to build up population with favourable fixable genes for effective crop yield and quality improvement.

A clear knowledge of the type of gene action, its magnitude and composition is useful in development of new genotype or hybrid.

There are several techniques for evaluating the varieties or lines in terms of their combining ability and genetic makeup. Among these, line x tester analysis as proposed by Kempthorne (1957) has been extensively used to assess the combining ability of parents and crosses for different quantitative characters as well as to study the extent and magnitude of heterosis for yield and its contributing characters. Line x tester analysis is popular as it helps in testing a large number of genotypes to assess the heterosis, combining ability and gene action.

Objectives:

Keeping in view all the above aspects, the present investigation on “Line x Tester analysis in ridge gourd” was undertaken with the following objectives.

1. To estimate the general and specific combining ability effects for fruit yield and its component traits.
2. To study the nature and magnitude of heterosis for fruit yield and its component traits.
3. To estimate the nature and magnitude of gene action involved in the inheritance of fruit yield and its component traits.
4. To identify superior cross combinations and parents for future use.