CHAPTER I
INTRODUCTION

Sesame (*Sesamum indicum* L.) is a member of the order *Tubiflorae* and family *Pedaliaceae* with chromosome number 2n=2x=26. It is probably the most ancient known oilseed used by man and its domestication is lost in the mists of antiquity (Weiss, 1983). Although originated in Africa, it spread early through West Asia to India, China and Japan which themselves became secondary distribution centers (Weiss, 1983).

It is an important annual oilseed crop in the tropics and warm subtropics. In India, sesame is cultivated in an area of 16.67 lakh ha with a production of 6.75 lakh tones annually and productivity 405 kg/ha (Anonymous, 2016). Being the fourth important oilseed crop in Indian agriculture after groundnut, rape seed and mustard, it is widely cultivated in the states of Uttar Pradesh, Rajasthan, Odisha, Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka, West Bengal, Bihar and Assam. In Gujarat, sesame is cultivated in the area of 2.36 lakh ha with a production of 1.24 lakh tones and productivity of 525 kg/ha (Anonymous, 2016).

The sesame is a self pollinated crop and the genus *sesamum* belongs to *Pedaliaceae* family. The genus *sesamum* consists of many species, but only *sesamum indicum* L. has been recognized as a cultivated species (Ashri, 1998). According to Kobayashi *et al.* (1990), 36 species have been identified, of which 22 species have been found in Africa, five in Asia, seven in both Africa and Asia and one species each in Crete and Brazil. There are three cytogenetic groups, of which 2n=26 group consist of the cultivated *S. indicum* along with *S. alatum, S. capense, S. schenckii, S. malabaricum*; 2n=32 group consist of *S. prostratum*, *S. laciniatum*, *S. angolense*, *S. angustifolium;* while *S. radiatum*, *S. occidentale*, *S. schinzianum* belong to 2n=64. Mainly due to the differences in chromosomal numbers across the three cytotaxonomic groups, there is limited cross compatibility among the species. Therefore, it has been difficult to transfer desirable characteristics such as drought tolerance and resistance to diseases and pest, from wild relatives into cultivated sesame (Carlsson *et al.*, 2008).

Sesame has played a major role in the rich and diverse health and cosmetic traditions of India. It is called as the "Queen of oilseeds" because of its excellent qualities of the seed, oil and meal. Generally, the oil content in sesame ranges from 34 to 63 per cent (Ashri, 1998; Baydar *et al.,* 1999; Uzun *et al.,* 2002; Were *et al.,* 2006). Genetic and environmental factors influence the oil content and fatty acid compositions in sesame (Carlsson *et al.*, 2008). Late maturing cultivars are reported to have higher oil content than early cultivars (Yermanos *et al.,* 1972) and the indeterminate cultivars accumulated more oil than determinate ones (Uzun *et al.*, 2002). Sesame is highly nutritive (oil 50%, protein 25%) and its oil is an excellent vegetable oil because of its high contents of antioxidants such as sesamin, sesamol and sesamolin and its fatty acid composition (Suja *et al*., 2004). The presence of antioxidants and about 85 per cent unsaturated fatty acids make the oil stable and it has therefore a long shelf life. Seeds are rich source of linoleic acid, vitamin E, A, B_1 and B_2; minerals including Ca and P. After oil extraction, the remaining meal contains 35-50 per cent protein, and is rich in tryptophan and methionine. Seed coats are rich in calcium (1.3%) and provide a valuable source of minerals (Johnson *et al*. 1979). Sesame cake is nutritious feed for dairy cattle and it can also be used as fertilizer (Ashri, 1998).

The yield improvement achieved through conventional hybridization followed by selection has been only marginal. Although sesame is largely a self pollinated crop, high level of heterosis for yield and its components has been reported (Susmita and Sen, 1992; Fatteh *et al*., 1995; Navadiya *et al*., 1995; Padmavathi, 1998; Jadhav and Mohrir, 2013). But, the commercial exploitation of this phenomenon is feasible only if the means of producing hybrid seeds economically could be made available. Further, with convincing reports on availability of heterosis and possibility of commercial hybrids, generation of cytoplasmic male sterility system in sesame using the possible wild donors can ease the production of hybrids. The sesame plant has distinct features favourable for hybrid seed production. This technology has been emphasized to sustain the yellow revolution and to meet the increasing domestic and export requirements of the country in the coming years. However, the scope for utilization of heterosis depends mainly upon direction and magnitude of heterosis. Estimation of heterosis may be helpful to determine the genetic basis of its observed effects. The heterotic hybrids may also produce desirable transgressive segregants in advanced generation. The choice of right type of parents is important for the development of superior hybrids in respect to yield and yield contributing characters. Hence, in order to develop high yielding hybrids, it would be desirable to identify better combining parents for different traits.

The attempts for the exploitation of heterosis on the commercial scale in autogamous crops have resulted in the development of number of high yielding hybrids and proved to be the most important genetic tool in enhancing yield potential. The development of improved high yielding varieties or best hybrids for commercial cultivation would require detailed genetical evaluation of parents for their combining ability, which refers to the capacity or ability of a genotype to transmit its superiority to its crosses. The choice of parents to be incorporated in hybridization programme is a crucial step for breeders, particularly if the aim is improvement of complex quantitative characters, such as yield and its components. The use of parents of known superior genetic worth ensures much better success. It requires extensive and detailed genetic assessment of existing germplasm as well as newly developed promising lines, which could be used in future breeding programme. The knowledge of combining ability together with *per se* performance provides guideline to plant breeders in selecting the elite parents and desirable cross combinations to be exploited further and at the same time reveal the nature and magnitude of gene action involved in the inheritance of various traits.

For breaking the present yield barrier and evolving varieties with high yield potential, it is desirable to combine the genes from genetically diverse parents. The success in identifying such parents mainly depends on the gene action that controls the trait under improvement, combining ability and genetic makeup. There are several techniques for evaluating the varieties or lines in terms of their combining ability and genetic makeup. Of these, diallel, partial diallel and line x tester mating designs are in common use. 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 with lesser number of crosses to assess the heterosis, combining ability and gene action.

Keeping all these facts in view, the present investigation on “Heterosis and combining ability analysis for seed yield and its components in sesame (*Sesamum indicum* L.)” was undertaken with following objectives;

1. To estimate heterobeltiosis and standard heterosis for seed yield and its components.
2. To estimate general combining ability and specific combining ability of the parents and crosses, respectively for yield and its components.
3. To study the nature and magnitude of gene action involved in the inheritance of yield and its components.