Chapter I

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_Sesamum indicum_ L., belonging to the family Pedaliaceae is perhaps one of the oldest, annual oilseed crops known to man. On the basis of the occurrence of wild sesame _S. indicum_ ssp. _malabaricum_ in India, antiquity of cultivation and diversity of cultivated forms, India is now considered to be the basic centre of origin of the crop (Joshi, 1961).

Sesame seed oil is valued for its high quality and stability. It is used as a salad and cooking oil as well as in the manufacture of margarine, shortening (or vanaspati), soap, paints and insecticides. Small quantities of it are also used in pharmaceutical and perfume industries. In rural areas, it is still used as an illuminant (Brar and Ahuja, 1979).

Sesame seed yields are the lowest of all major oilseeds. The reasons, according to Brar and Ahuja (l.c.) are poor plant type, poor cultivation technique and lack of intensive systematic research efforts. Sesame being both thermo-sensitive and photo-sensitive, requires a well-drained soil (no water-logged or acidic soil) and only moderate rainfall. That is why, unfavourable weather such as extended rainy and cloudy periods after flowering, can even lead to complete failure of the crop (Anon. 1977). Some sesame cultivars insensitive to photoperiod are available now, but they are sensitive to excessive moisture condition and are low yielding. Indeterminate flowering habit and shattering of capsules at maturity lead to a poor harvest index of the crop. Under irrigated conditions, many sesame cultivars continue to flower, while
early formed capsules start shattering. As a result, a substantial proportion of flowers never develop into capsules or do not mature, while the others shed seeds (Brar and Ahuja, 1979).

The main bottle-neck in increasing productivity and exploiting its genetic potentiality is in the shattering of mature capsules before harvest and the long duration taken for continuous flowering at the nodes of the indeterminately growing stem concurrent with the asynchronous setting and maturity of capsules, thereby preventing early harvest. An early maturing sesame variety having non-shattering capsules along with unimpaired seed and oil yield would help to maximise the return from this crop. The success in breeding of such an improved sesame variety would largely depend on an appropriately planned programme based on the knowledge of inheritance of the appropriate yield contributing traits along with the above mentioned traits.

Inspite of the somewhat inconsistent potentiality of the available sesame varieties and the marginal profitability achieved through improved agronomic practices, sesame cultivation for seed oil is gradually gaining importance in specific agro-climatic and soil zones to meet the demand for oilseeds in India to some extent. The climates are so diverse in India, that sesame is sown all the year round at some places except for the months of April and May.

In West Bengal, sesame cultivation is gradually gaining popularity through the cultivation of blackish-brown seeded variety B-67, black seeded variety B-14 and brown seeded variety B-9. Since, these sesame cultivars are not well adapted to the diverse soil and
climatic zones which are potential areas in this state, the use of the available sesame cultivars is restricted only in some optimal zones. This practically restricts its production in the state, using the sesame varieties which appear to have low productivity. So, inspite of the very good quality of edible oil coupled with the demand for edible oil in general, sesame is not emerging as a dependable supplement or substitute to the need.

Unavailability of high yielding sesame cultivars responsive to improved agronomic practices, resistant to pests and diseases as well as tolerant to heat and drought, among other things, are considered to be the major factors for low yields of sesame. Intensive efforts are being made in different research stations in India and by the Indian Council of Agricultural Research under the auspices of the All India Co-ordinated Research Project on Oilseeds to evolve high yielding sesame cultivars. But elite or promising sesame varieties with advantageous yield contributing characters have not yet been evolved to attract extended cultivation. Sesame cultivars with shattering capsules at maturity which impair seed yield, predominate in India. Most of the other sesame growing countries are, however, giving emphasis to non-shattering capsule type to evolve high yielding sesame cultivars. Kinman and Martin (1954) successfully transferred the indehiscent capsule character without transferring associated undesirable traits of donor species into a desirable genotype of sesame through multiple crosses. It is, therefore, imperative that intensive research efforts should be undertaken for the improvement of seed and oil yield simultaneously with emphasis on upgrading of the relevant yield contributing characters.
The disadvantages rendered to plant breeders in respect of sesame breeding are its susceptibility to water-logging, to high or low soil pH as well as to a host of insects, pests and diseases. In addition, it responds very poorly to improved agronomic practices and the capsules dehisce to shed their seed before harvest.

However, the several advantages to plant breeders in planning improvement of sesame through hybridization programme (Kinman and Martin, 1954) are (i) ease in producing F₁ hybrids due to its floral biology; (ii) large number of seeds produced per capsule and per plant; (iii) greater genetic variability than most self-pollinated crops, thus making available a large number of genetic markers; (iv) possibility of growing large plant population in small area; (v) relative ease in inter-specific hybridization to enable transfer of desirable plant characters from species related to cultivated sesame; (vi) possibility of raising as many as three or four crops per year at certain places due to a relatively short life cycle and generally lack of seed dormancy; (vii) potential economic value of the crop.

The objective of the present study is to explore the possibility of further improvement of this oilseed crop through intensive inter-varietal cross-breeding so as to determine the pattern of genetic control which may lead to development of a suitable strategy for improvement of advantageous yield contributing characters, identify the best sesame parents which would produce such qualities in their hybrid progeny as well as to identify and isolate advantageous F₁ hybrids for high seed yield and oil content.
Estimation of combining ability is imperative to choose parental lines on the basis of their cross combinations for initiation of a breeding programme. The understanding of the genetics of yield and its component characters, particularly their nature of inheritance is important. Griffing's (1956) analysis of diallel crosses provided estimates for gca effects of parental lines and sca effects of cross combinations. The comparisons between gca and sca effects of parental lines and cross combinations indicate the nature of inheritance of yield and its component characters. It has been suggested that the relative importance of gca and sca in determining progeny performance should be assessed by the ratio \( \frac{2 \sigma^2_{gca}}{2 \sigma^2_{gca} + \sigma^2_{sca}} \). The closer this ratio is to 1, the greater would be the predictability based on gca. Since sesame is gradually gaining importance as an upcoming pre-kharif catch crop in West Bengal through the cultivation of blackish-brown seeded variety B-67, black seeded variety B-14 and brown seeded variety B-9, the present study is expected to reveal the strategies for genetic improvement of the efficiency for seed and oil production.